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CONSERVATION AND WATER POWER.

In a recent address to the American Forestry Association, which met at Washington, D. C., last month, Mr. Walter L. Fisher, Secretary of the Interior, made a significant statement regarding the development of water power in connection with the public domain and one which shows clearly that the federal administration has possessed a full appreciation of the urgent necessity of developing the water powers of the country if a true policy of conservation is to be carried out. This address was referred to in our last issue.

Mr. Fisher made it clear in his address that under the present laws it is almost impossible to proceed with waterpower development without either entirely abandoning efforts to protect the public interest, or else requiring the corporation undertaking the development to accept a revocable franchise. Neither of these extreme courses can be acceptable to all partes concerned and the result has been stagnation where activity should be in evidence. It is quite necessary that Congress should pass enabling legislation containing the proper authority before any progress can be made along lines acceptable to both the financial interests involved and the officials of the Government who are aiming to safeguard the public welfare.

That the conditions which the federal administration has been contending for are not impossible or unacceptable to those companies willing to admit a legitimate public interest in natural resources, the recent contract in connection with the electrification of the Chicago, Milwaukee & Puget Sound Railroad gives evidence. The Great Falls Power Company, which is to supply energy for this project, operates independently of the federal Government, but in order to transmit electrical energy to the point of consumption it was necessary to cross the public domain. The permit for doing this was issued under conditions similar to those which are favored by the Department of the Interior for incorporation in permits relating directly to the development of water powers. Authority for this was found in a rider attached to an appropriation bill in March, 1911. The officials of the power company and of the railroad have not found these conditions an obstacle to their procedure, but have accepted them as reasonable limitations upon the use of the public domain. The conditions involved a small rental charge, to be adjusted every ten years; publicity of the records of the power company; regulation of rates by local or state authority; and a prohibition against any claim for the value of an easement in case the public at any time

should take over the project. Some may think provisions of this sort too drastic, but they were considered acceptable by the corporations involved.

In this connection one statement by the Secretary is very significant. It is to the effect that the present difficulties of the situation and the fact that legislation has not already been secured from Congress are due to an effort to discredit the entire conservation movement and to obstacles thrown in its way by an element which had hoped to secure water-power rights without any interference whatever from the Government. On the other hand there is another element among the power interests quite ready to recognize the public interest in the matter and to submit to reasonable regulation. As soon as enabling legislation is secured, the latter element will not hesitate to proceed with the much desired developments.

RATING OF ELECTRICAL MACHINERY.

In referring to the last monthly meeting of the American Institute of Electrical Engineers, attention was called to the fact that with mica insulation, operating temperatures were being used which far exceed the limits prescribed by the Standardization Rules of the Institute. This fact was brought out by the paper by Mr. B. G. Lamme on "High-Speed Turbo-Alternators," and the discussion which followed it. In an address this week in Chicago, which is reported elsewhere in this issue, Mr. Lamme has taken up the subject of temperature rise more specifically and in detail, and pointed out the need for a revision of the Standardization Rules in conformity with the most modern practice as regards the construction, testing and rating of electrical machinery.

The need for such revision of the Standardization Rules has been evident to many members of the Institute for some time and the midwinter convention of the Institute, which is to be held during the last week of this month, will devote itself to this subject exclusively. The program of this convention will be found in this issue and it will be noted that the two principal committee reports deal with temperature, insulation and rating. The subject is to be well covered and a very long program of papers, which looks indeed formidable, has been prepared, but as all papers are to be printed well in advance and will not need to be read at the convention, it will probably be possible to compass the entire list in the prescribed three days and two nights.

In revising the Standardization Rules of the American Institute it should be borne in mind that the International Electrotechnical Commission is working upon this same subject, and a report from its Committee on Rating, which met last month, should be available before this convention. It is greatly to be desired that the rules adopted by the American Institute and by the International Commission should be in agreement, so that uniformity in ratings and similar questions should be reached not only nationally but internationally.

A METER FOR MEASURING WATTS PER CANDLE.

The life of an incandescent lamp depends primarily upon the temperature at which it is operated and this has a direct relation to the watts expended per candle of light emitted. This ratio of power to light is commonly referred to as the efficiency of the lamp. This, however, is not logical, as the term would more properly refer to the reciprocal quantity representing the ratio of output to input, and could well be replaced by "specific consumption," since it indicates the power consumed per unit of useful output.

In rating a lamp it is consequently necessary to determine the voltage at which the lamp shall have a specific consumption, and it may be mentioned in passing that this value changes rather rapidly with the voltage. The specific consumption, or the efficiency, may be determined by separate measurements of candlepower and wattage, and the performance of the necessary arithmetic, but it is far more convenient to have an instrument from which this value may be directly read off. Such an instrument was devised some years ago by Messrs. Hyde and Brooks at the Bureau of Standards. This apparatus was so arranged that the motion of the photometer head varied the resistance in the potential circuit of a wattmeter. The reading of the wattmeter was thus modified in accordance with the candlepower of the lamp being measured, and the variation of resistance with the travel of the photometer head was so chosen that the instrument read directly in watts per candle.

Another method for accomplishing this purpose was devised by Dr. Herbert E. Ives, and consisted in attaching to the needle of the wattmeter measuring the power expended in one lamp a shutter which controlled the amount of a diffusing surface illuminated by the other lamp which was exposed to the photometer screen.

A third method of accomplishing the desired result is described by Dr. Edward P. Hyde in this issue. It consists in passing the current of one lamp through a resistance proportional to the candlepower of the other lamp. When the products of these quantities are equal, as tested by a potentiometer device, the lamps have the same specific consumption. In practice one of the resistances is varied to obtain this equality, in which case the efficiencies are not the same but have a definite ratio. The value for the lamp under investigation is thus obtained not absolutely but in terms of the comparison lamp, and the method may therefore be designated as a differential one.

However, as photometric work of this character is always carried on by reference to a comparison lamp of known properties, this is quite sufficient. For the details of the ingenious arrangement by which Dr. Hyde has attained this result, reference must be made to the article itself.

UNITS OF THERMAL MEASUREMENT.

A century ago when the nature of heat was not generally understood it was regarded as a definite material or substance rather than as a form of energy, as it is today. When men came to make measurements of temperature, quantity of heat and other thermal magnitudes, they made use of a special system of units devised for this especial purpose. These units became so firmly established that even when the nature of heat energy came to be recognized and the transformation of this form of energy into others, and of other forms into heat, was fully demonstrated, and the principle of the conservation of energy fully recognized, the old units were still retained and are in common use up to the present.

With the recognition of the identity in nature of the different forms of energy, including heat, the need for separate units in measurements of heat disappeared, and today there is little excuse for the retention of these old units, which are incommensurate with the units employed for measuring other forms of energy. However, the fact that a majority, perhaps, of heat measurements, especially in the laboratory, have not involved transformations into other forms of energy, has prevented the confusion which might otherwise have arisen to a greater extent from the retention of the old units. Today, when we approach a condition of general use of units based upon the absolute system, it would seem advisable to discard the old thermal units entirely. With more frequent measurements of the same or a portion of the same energy in two different forms, the desirability of a common unit of energy for measurements of the different forms becomes more and more evident.

Where electrical measurements are involved, the unit commonly used for electrical energy naturally presents especial claims for recognition on account of its relation to the absolute C. G. S. system. The joule or watt-second is not only a very convenient unit, but one which is well established in electrical practice. When electrical men are led into measurements in other fields, there is a natural tendency to retain this unit and those associated with it, such as the watt for power. Thus, in measurements upon the electrical furnace, it is convenient to discard the old thermal units of heat, heat conductivity, etc., and substitute therefor the watt, the joule and other units based upon these. In measurements upon thermal engines also, especially where connected to electrical machinery, a similar convenience would result if all thermal measurements were in terms of the electrical units and those derived from them.

The suggestion made by Messrs. H. G. Stott and Haylett O'Neill at last year's convention of the American Institute of Electrical Engineers, for rating steam boilers in such a unit, is an admirable one and will appeal to every electrical engineer. As announced two weeks ago, the suggestion has been adopted by a joint committee of the American Institute of Electrical Engineers and the American Society of Mechanical Engineers, and this should guarantee its gradual introduction into general practice. When boilers were used in connection with reciprocating steam engines alone, the advantage of such a rating was not apparent to the mechanical engineers, since the units used in measuring mechanical power were themselves isolated in their relation to other units of energy, as were those used for measuring thermal energy and power. With the same desire for convenience in mind, however, the "boiler horsepower" was originated, but unfortunately it was not taken to represent the same rate of energy change as the mechanical horsepower, and consequently the simplification involved in the latest suggestion was not attained. With the present tendency to eliminate the horsepower itself as a unit of power and to substitute the kilowatt, an advantage will be gained by the rating of boilers in the more general electrical units, even when they are used only for generating mechanical power.

The new unit suggested for boiler rating is the "myriawatt" and is defined as 10,000 watts, its advantage residing in the fact that it is a decimal multiple of the usual electrical unit of power. The fact that it is ten times the kilowatt, in which unit electrical generators are rated, may sometimes have a special convenience, owing to the fact that the over-all efficiency from coal pile to switchboard is of the order of magnitude of ten per cent.

While considering the simplification of units and their unification in a decimal system, it may be well to point out that the kilowatt-hour, which is the common commercial unit for electrical energy, does not fall in with the simple system of the other electrical units, which are based upon the second as a unit of time. Thus the ampere is one coulomb per second, and the watt is one joule per second. To confine ourselves to this system, electrical energy should be measured in joules or some multiple thereof. This consideration has been receiving some attention in England lately, owing to the fact that while the kilowatt-hour is the accepted unit for energy, it does not usually pass under that name, but is known as a "Board of Trade unit," or simply as a "unit." A demand has arisen for some definite and short name. One suggestion has been to call this unit a "kelvin," a name which was authorized by the Board of Trade years ago but never came into general usage, and to which certain objections have been made. Another suggestion has been to apply the name "kelvin" to a unit representing 10,000,000 joules, which would give a unit of convenient commercial size. A joule represents 10,000,000 ergs, the erg being the C. G. S. unit, and the new suggestion would thus give the same multiple for a practical commercial unit. This unit would represent 2.78 kilowatt-hours. It would thus be of a convenient size and would be connected by only a decimal factor with the C. G. S. system and the other common electrical units.

Brooklyn Edison Company Section, National Electric Light Association, Has Big Meeting.

Nearly 600 members of the Brooklyn Company Section, National Electric Light Association, all of them employees of the Brooklyn Edison Company, and a large number of out-of-town visitors, gathered together Monday evening, January 13, at the large auditorium in the Johnston Building for the first meeting of the year, which was also the first meeting after the appointment of W. F. Wells as general manager of the company.

M. H. Bennett, chairman of the section, presided.

After a selection by the Edison orchestra, composed exclusively of employees of the company, the paper of the evening, the subject of which was "Commercial Engineering," was delivered by James L. Wiltse. This paper indicated the important part that engineering now plays in the commercial development of the central station. It covered the necessity for, and the present status of, illuminating engineering, power engineering, electric automobile engineering and heating engineering, and vindicated the practical value to the central station of this kind of work. The discussion which followed was spirited and interesting and demonstrated how much good this company-section organization, which has now been in existence some four years, has been doing for its members. It has certainly developed young men who can think on their feet and express themselves clearly.

Among those who participated in the discussion were: N. J. Trompen, W. H. Grove, T. S. Bates, C. H. Stevens, J. D. Butt, H. K. Bodine, G. J. Liebman, F. A. Wegner, D. Brown, T. W. Flowers, C. H. Thurling, C. A. Graves, E. M. Podeyn and J. Donlon.

The new general manager was asked to say a few words and spoke on the importance of membership in the Brooklyn company section. He told something of old times in the electrical growth of Brooklyn and ended by an appeal for that co-operation necessary to produce the best results.

T. I. Jones, general sales agent of the Brooklyn Company, delivered an address on the "Development of our Business During 1912." Mr. Jones's address was illustrated with about 100 lantern slides, showing the growth of Brooklyn electrically during 1912 along all lines,—light, power, sign-lighting, street and park lighting, electric automobile increase, etc. His description of the methods of co-operation with electrical contractors, which have been adopted and are now in use in Brooklyn, were especially interesting, and the result shows how central-station business can be improved by intelligent work along these lines.

Short addresses were then made by Mr. Cox, of the Public Service Electric Company, Newark, N. J.; Mr. Littlefield, of the NewYork Edison Company; Mr. Becker of the United Electric Light & Power Company, New York; Professor George F. Sever, electrical engineer of New York City; Mr. Brown, of the Westinghouse Electric & Manufacturing Company; Mr. Coleman, of the United Electric Light & Power Company; Mr. Rosenquest, of the Bronx Electric Company; Mr. Onken of the *Electrical World;* Mr. Barton, of the New York & Queens Electric Light & Power Company; Mr. Wintner, of the General Electric Company.

The chairman announced the initiation of a campaign for members, the object of which was to bring the membership up over the 1,000 mark, and asked the help of every member of the company section toward this end.

Vaudeville and refreshments closed the evening's proceedings.

To Determine Range of Arlington Station.

Officials of the Navy Department have instituted experiments to determine the maximum range of the new high-power radio station at Arlington, Va. The cruiser *Salem* is expected to leave today upon a voyage across the Atlantic, during which observations will be made regarding the maximum distance at which the signals from Arlington can be perceived. It is expected that communication can be maintained up to a distance of 4,000 miles. Under good conditions it is expected that the Arlington station will be able to communicate with London, Paris and even Berlin, as well as with the station to be erected at Panama.

Employer's Liability in Indiana.

According to the terms of a new employer's liability bill which has been introduced in the State Legislature of Indiana, electric light and power companies and traction companies may be compelled to indemnify such of their employees as are injured in the performance of duty to the extent of 50 per cent of their weekly wage for a period not longer than eight years after the accident, nor in the sum of more than $3,500. In case o. total disability as the result of an accident to a workman, the employer may be compelled to pay 50 per cent of the weekly wage for a period not exceeding ten years nor in the sum of more than $5,000. Work upon electrical apparatus or live wires is designated in the measure as one of the more hazardous occupations.

Copper Exports.

Exports of copper for the week ending January 23 totaled 2,906 tons; since January 1, 17,967 tons; same period last year, 24,091 tons.

Mine Safety Association Formed.

As the result of a conference which was held under the auspices of the United States Bureau of Mines last September, between men who are interested in the saving of the lives of miners, there has been formed a society known as the American Mine Safety Association, with headquarters at Fortieth and Butler Streets, Pittsburgh, Pa. This association, which is now enrolling among its members the leading coal and metal-mine operators, mining engineers, and mine safety engineers of the country, has for its purpose the conservation of the lives and health of the miner and a reduction in property loss due to explosions or fires in mines. It will attempt to place before the miners standard methods to be used in rescue work and in first aid to the injured.

Meeting of Boston Company Section.

P. M. Lincoln, of the Westinghouse Manufacturing Company, addressed the Boston Edison Company Section of the National Electric Light Association in Boston on January 21, on the subject of the construction of electric motors. F. A. Waldron, industrial engineer, of New York, described the new service station now in process of erection, for the Boston Edison Company, on Massachusetts Avenue, in that city. Slides showed the plans for the buildings and the structures already erected. There will be a group of seven buildings, four for storage purposes, a laboratory, office building and engine house. The buildings will have 226,000 square feet of floor space.

Medical Director Appointed for Telephone Companies.

Alvah H. Doty, former health officer of New York, has been appointed medical director of the Employees' Benefit Fund Committee of the American Telephone & Telegraph Company, the Western Union Telegraph Company and the Western Electric Company. In connection with the pension and sick-benefit plan a system of medical supervision and preventative sanitation will be established.

Employees found to be suffering from communicable diseases, such as tuberculosis, will be removed for treatment and care. Proper lighting, good ventilation, sanitary plumbing, pure water and other hygienic elements of workrooms will be properly cared for.

Mine Safety Lamps.

The rapidly growing use of electric safety lamps for miners is attested by the fact that one large coal-mining company will use over 300,000 tungsten lamps for this purpose this year.

Walter F. Wells.

In his presidential address to the National Electric Light Association a couple of years ago, W. W. Freeman, then vice-president and general manager of the Brooklyn Edison Company, called attention to the great possibilities for personal development and worth to one's self for the young man in the central-station business. Mr. Freeman himself had risen from the ranks, occupying many minor positions and learning to his heart's content that only those who have first learned to obey can rise to positions of command. It is interesting to note in connection with the subject of this sketch that in succeeding his esteemed chief Walter Farrington Wells has had a career similar in many ways to that of his distinguished predecessor.

Mr. Wells was born in Rahway, N. J., January 10, 1870, receiving his technical education at Rutgers College. Soon after leaving college he was employed by the Brooklyn Edison Company as draughtsman, then foreman and assistant electrician. He was made electrical superintendent in 1894. In 1897 he became assistant general manager of the Manhattan Electric Light Company, in charge of the technical departments. When this company was merged, in 1900, with the New York Edison Company Mr. Wells was made district superintendent. In 1899 he was appointed superintendent of the Mount Morris Electric Light Company, holding this position for about a year. About this time the Edison Company made its first installation of rotary converters, and other equipment for 6,600-volt transmission, and the details of this change-over were left to Mr. Wells, who also was actively engaged in the preparation of the plans and superintended the installation of the electrical equipment of Waterside Station No. 1. Upon the completion of this station Mr. Wells became superintendent.

The death of E. A. Leslie, vice-president and general manager of the Edison Electric Illuminating Company of Brooklyn, brought about the creation of the position of general superintendent, and Mr. Wells was appointed to fulfill these duties. Quite recently he was appointed acting general manager, and upon the resignation of Mr. Freeman to become vice-president and general manager of the Alabama Interstate Power Company at Birmingham, Ala., Mr. Wells was made general manager.

Mr. Wells is a member of the National Electric Light Association, a fellow of the American Institute of Electrical Engineers, a member of the Institute power-station committee, general chairman of the technical committee of the National Electric Light Association, and chairman of the committee on steam turbines of the Association of Edison Illuminating Companies. He is a familiar figure at the national and state conventions of central-station and engineering organizations, has done a great deal of active work in the preparation of reports of various committees, and has contributed a number of interesting and instructive articles to the technical press.

Walter F. Wells,
General Manager, Edison Electric Illuminating Company of Brooklyn.

He is deeply interested in the local company section work and in the welfare work of the Brooklyn Edison Company, and through sheer ability and great adaptability has won the confidence and esteem of everyone associated with him.

London Subway 50 Years Old.

On January 10, 1863, the first train was run on the Metropolitan Railway, the first underground railway in London, England. At that time steam was used for operation and as the locomotives burned soft coal, conditions were extremely disagreeable and unhygienic. In 1904 the road changed to electric operation.

Association of Corporation Schools.

The National Association of Corporation Schools was organized on January 24, 1913. It is to be made up, as to its active membership, of corporations which have technical and other schools. The objects as given are to aid corporations in the education of their employees; (a) by providing a forum for the interchange of ideas and (b) by collecting and making available data as to successful and unsuccessful plans in educating employees.

There were 60 persons in attendance. The officers elected are as follows: President, Arthur Williams, New York Edison Company; first vice-president, E. St. Elmo Lewis, Burroughs Adding Machine Company; second vice-president, C. P. Steinmetz, General Electric Company.

There are to be three members of the Executive Committee elected annually, but this full board was elected yesterday: J. W. L. Hale, Pennsylvania Railroad Company; G. M. Basford, American Locomotive Company; F. C. Henderschott, New York Edison Company; A. E. Corbin, Packard Motor Car Company; A. F. Bardwell, Yale & Towne Manufacturing Company; W. D. Kelly, Consolidated Gas Company; M. M. Mix, Dodge Manufacturing Company; J. E. Rogers, National Cash Register Company; C. R. Dooley, Westinghouse Electric and Manufacturing Co. The secretary-treasurer is to be appointed by the Executive Committee. The constitution and by-laws submitted by the committee were adopted, the Executive Committee being given power to make recommendations of changes within thirty days, and also to fix annual dues, etc. There will be associate membership for all interested in the work.

Ratification of Wireless Treaty.

Nearly all of the 31 nations which participated in the wireless conference at London last summer have ratified the treaty regulating radiotelegraphy, and it is expected that ratification will be exchanged in London in the near future. The Senate of the United States ratified the treaty this month.

Independent Telephone Convention

The sixteenth annual convention of the National Independent Telephone Association will be held at the Hotel LaSalle in Chicago on February 18 to 20.

Program of the Midwinter Convention of American Institute of Electrical Engineers.

The American Institute of Electrical Engineers will hold a midwinter convention at the Engineering Societies Building, New York City, February 26, 27 and 28. This convention is to be held under the auspices of the Standards Committee, which is preparing data for a revision of the Standardization Rules. The convention will be devoted to a discussion of this subject, and proposed modifications will be presented for comment and suggestions. The subcommittee on the Revision of Rules and subcommittee on Rating will each present a paper. The remaining papers have been divided into four groups, as follows: (1) Heating, Heat Measurements, Rating by Heat. (2) Methods of Determining Losses in Apparatus. (3) Methods of Testing Apparatus for Performance. (4) Miscellaneous Subjects Relating to Rating.

The following is a provisional program of papers so far arranged.

Wednesday, February 26.

Introductory address by the chairman of the Standards Committee. "Temperature and Electrical Insulation," by C. P. Steinmetz and B. G. Lamme, of the subcommittee on Revision; "Method of Rating Electrical Apparatus," by W. L. Merrill, W. H. Powell and Charles Robbins, of the subcommittee on Rating.

These will be followed by the following papers in Group 1: "Notes on Internal Heating of Stator Coils," by R. B. Williamson; "Measurement of Temperature on Rotating Electric Machines," by L. W. Chubb, E. I. Chute and O. W. A. Oetting; "Method of Determining Temperature of Alternating-Current Generators and Motors and Room Temperature," by H. G. Reist and T. S. Eden; "Thermocouples and Resistance Coils for the Determination of Local Temperatures in Electrical Machines," by L. T. Robinson and J. A. Capp; "Methods of Determining Temperature of Transformers and of Cooling Medium," by S. E. Johannesen and G. W. Wade; "Methods of Measuring Temperature of Transformers," by C. Fortescue and W. M. McConahey; "Correction of Transformer Temperature for Variation of Room Temperature Taking Into Account Both Copper and Iron Losses," by C. Fortescue; "The Temperature Rise of Stationary Induction Apparatus," by J. J. Frank and W. O. Dwyer; "Effect of Room Temperature on Temperature Rise of Motors and Generators," by M. W. Day and R. A. Beekman; "Effect of Air Temperature, Barometric Pressure and Humidity on the Temperature Rise of Electrical Apparatus," by C. E. Skinner, L. W. Chubb and Phillips Thomas; "A Laboratory Investigation of Temperature Rise as a Function of Atmospheric Conditions," by C. B. Blanchard and C. T. Anderson; "Laws of Heat Transmission in Electrical Machinery," by Irving Langmuir; "Current Rating of Electric Cables," by R. W. Atkinson and H. W. Fisher; "The Heating of Cables Carrying Current," by S. Dushman.

Thursday, February 27.

Papers in Group 2 as follows: "Induction-Motor Load Losses," by H. G. Reist and A. E. Averrett; "Stray Losses in Induction Motors," by A. M. Dudley; "Notes on Induction-Motor Losses," by R. W. Davis; "Losses in Transformers," by W. W. Lewis; "Stray Losses in Transformers," by C. Fortescue and W. M. McConahey; "Determination of Load-Loss Correction Factors for Rotating Electric Machines," by E. M. Olin and S. L. Henderson; "Load Losses of Alternating-Current Generators," by W. J. Foster and E. Knowlton; "Notes on Stray Losses in Synchronous Machines," by F. K. Brainard; "Stray Losses in Direct Commutating Machines," by H. F. T. Erben and H. S. Page; "The Determination of Stray Losses from Input-Output Tests," by L. T. Robinson; "Sources of Error in Efficiency Determination of Rotating Electric Apparatus," by Elma I. Chute and William Bradshaw; "Commutator and Brush Losses," by W. N. Motter; "Brush Friction and Contact Losses," by H. F. T. Erben and A. H. Freeman; "Methods of Determining Brush Losses Due to Contact and Friction," by H. R. Edgecomb and W. A. Dick; "Commutation and Brush Losses," by C. E. Wilson.

Friday Morning, February 28.

Papers in Group 3 as follows: "Comparison of Methods of Loading Large Alternating-Current and Direct-Current Generators and Synchronous Converters for Factory Temperature Test," by F. D. Newbury; "Comparison of Methods of Making Load Tests on Alternating-Current Generators and on Induction Motors," by E. F. Collins and W. E. Holcombe; "Notes on Method of Making Load Tests on Large Induction Motors," by A. M. Dudley; "Load Tests on Transformers," by J. J. K. Madden; "Sources of Error in Transformer Tests," by W. M. McConahey and C. Fortescue.

Friday Afternoon.

Papers in Group 4 will be presented as follows: "Rating of Oil Circuit-Breakers with Reference to Rupturing Capacity," by G. A. Burnham; "The Sphere Spark Gap," by S. W. Farnsworth and C. Fortescue; "Calibration of Spark Gap," by L. W. Chubb and W. A. Thomas; "Potential Waves of Alternating-Current Generators," by W. J. Foster; "Wave-Form Distortions and Their Effect on Electrical Apparatus," by P. M. Lincoln; "A Proposed Wave-Shape Standard," by Cassius M. Davis; "The Experimental Determination of the Regulation of Alternators," by A. B. Field; "Regulation of Definite-Pole Alternators," by H. H. Mortensen; "Generator and Prime-Mover Capacities," by David B. Rushmore and E. A. Lof.

Sessions will be held every morning, afternoon and evening except on Friday, when the evening will be devoted to a reception and dance at the Hotel Astor.

United Independent Telephone Association of America Organized.

A new national association of independent telephone interests was formed at Pittsburgh, Pa., on January 16. About 100 representatives of independent telephone companies in Pennsylvania, New York, New Jersey, West Virginia and Ohio were present at the organization meeting, which was presided over by J. Walter Barnes, of Fairmont, W. Va. Under the qualifications for membership the amended constitution that was finally adopted states that:

"This association shall be composed of members who represent telephone companies independent of, and not owned or controlled by, the American Telephone & Telegraph Company, directly or indirectly; and no person or company shall be eligible to membership in this association who represents a telephone company in which the American Telephone & Telegraph Company, or any of its associated or allied companies control or hold a substantial financial interest; and in the event that any such interest or control shall be acquired by the American Telephone & Telegraph Company, or any of its associated or allied companies, the membership so affected shall immediately cease."

The charter membership consists of 52 independent telephone companies in the East. The permanent officers elected for the ensuing year are:

President, J. Walter Barnes, Fairmont, W. Va.; vice-president, E. D. Schade, Johnstown, Pa., and John H. Wright, Jamestown, N. Y.; secretary, H. E. Bradley, Philadelphia, Pa.; treasurer, T. J. Shufflin, Butler, Pa.; directors, B. G. Hubbell, Buffalo, N. Y.; John H. Wright, Jamestown, N. Y.; J. A. Haven, Brookville, Pa.; W. J. Uhl, Logansport, Ind.; C. H. Wilson, Philadelphia, Pa.; E. D. Schade, Johnstown, Pa.; B. L. Bullman, Marietta, O.; Charles West, Philadelphia, Pa.; E. J. Moore, Point Marion, Pa.; G. E. Crist, Blairsville, Pa.; Wm. S. Paca, Oil City, Pa.; W. H. Wilson, Erie, Pa.; K. B. Schotte, Kittanning, Pa.; J. Walter Barnes, Fairmont, W. Va.; J. G. Splane, Pittsburgh, Pa.

It was stated at the meeting that the new organization does not mean to conflict with the National Independent Telephone Association nor with any of the state associations. It is proposed to hold the next meeting at Washington, D. C., next May or June, but this has not been fully decided.

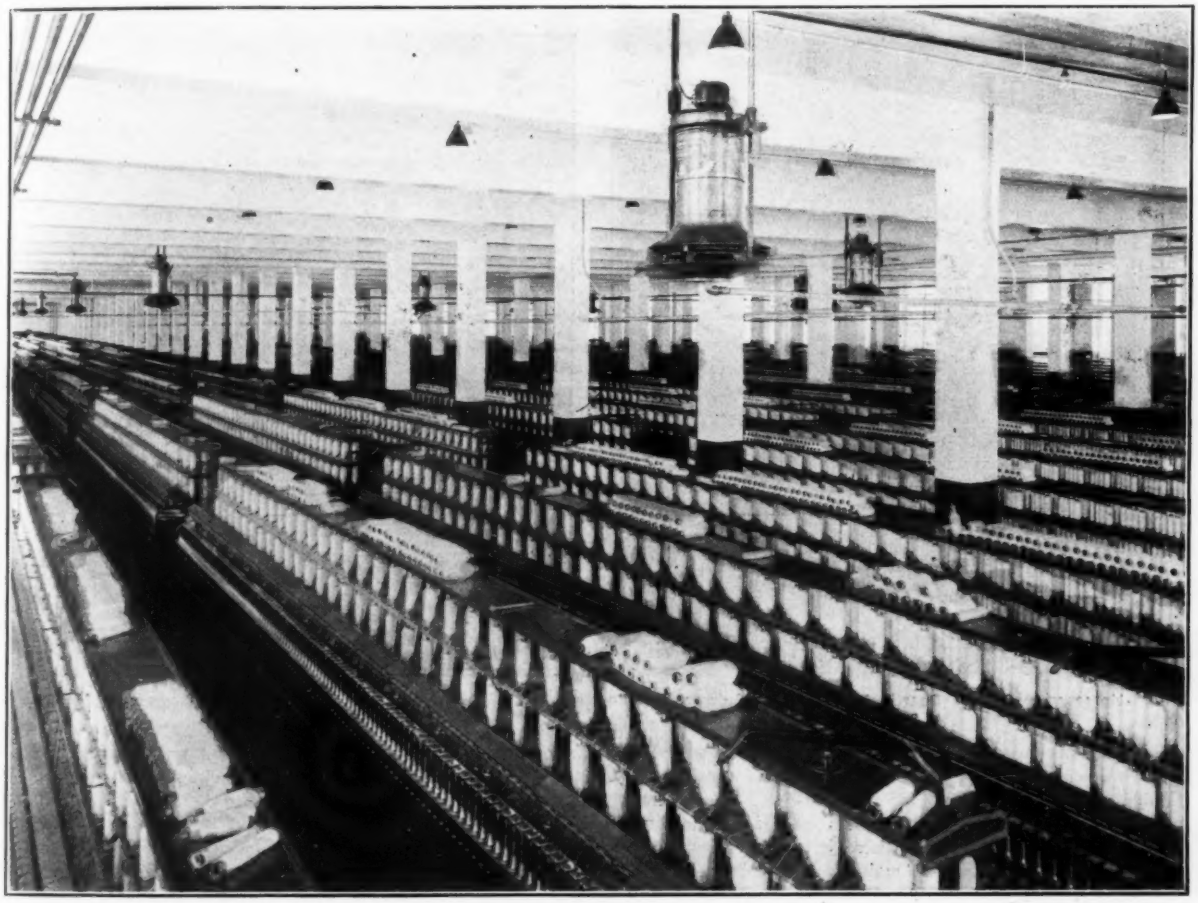
Electricity in Cotton Mills.

The use of motors in cotton mills has been the means of increasing production from two to ten per cent, depending on the efficiency of the installation. Operating data on several typical cotton mills purchasing power are given in this article together with a discussion of the general features of mill electrification.

The application of electric motors to the driving of textile-mill machinery has been one of the most conspicuous industrial developments within the past 20 years, and still the proportion of electrically driven textile mills, both in England and the United States, is considerably below what may fairly be anticipated within the next five years.

It is true that the production of power required for textile mills is an incident or detail, and usually the cost of power does not exceed five per cent of the value of the product, and yet, in a single 5,000-spindle mill the saving in power costs by changing from steam to central-station electric drive amounted to $3,300 annually.

The cotton manufacturing plant has attained the largest growth of any branch of the textile industry, the annual value of cotton products in the United States being more than $530,000,000. In the Southern states, particularly in North and South Carolina, will be found, by far, the largest number of cotton mills. The present article will deal with conditions in this terirtory, an extended investigation having been made of electrically operated mills supplied by the Southern Power Company.



General View of Spinning Room of Cotton Mill Using Individual Motor Drive. 200 Motors Are Installed in This Department.

Cycle of Operations.

A clear understanding of the cycle of operations carried on in a cotton mill is essential before attempting an analysis of power requirements and applications.

First, the raw cotton from the bales is drawn, usually by means of a suction conveyor, to the picker room. In the opener and breaker picker the cotton is beaten, the fibers loosened and the material converted from a dense matted mass into a light flaky one. During this operation, also, much of the dirt and sand is removed from the cotton. The fiber then passes to the intermediate and then to the finishing pickers, each of these machines again beating the cottom, cleaning it and finally passing it to perforated screens which compress the fiber and deliver it as a lap which is formed into a roll.

The carding room is the next department into which the cotton is taken. The rolls from the pickers are placed on the carders where the fibers are drawn approximately parallel by a combing process. The stock enters these machines as a sheet of lap and is converted into what is called sliver, a round string-like mass about one-half inch in diameter.

The use of combing machines in a mill depends entirely upon the product being manufactured. In mills producing a fine grade of yarn the combing process follows carding. The combing machines supplement the work of the cards, sort-

ing out the fibers to a uniform length. The cotton leaves the combing department in exactly the same form as from the carding room.

Drawing is the next operation, the drawing frame receiving the sliver from either the combers or cards. This machine simply carries on to a greater degree the operation of drawing the fiber parallel. In this machine, however, several ends of sliver are fed between sets of drawing rolls and are drawn out into a single sliver approximately equal in dimensions to the sliver fed into the machine.

The first twist given the yarn is on the slubbers. Sliver from the drawing frames passes to the slubbers, which are equipped with drawing rolls and spindles, upon which bobbins are revolved, winding the drawn and slightly twisted stock. The slubbing, which is the name of the product as it leaves these machines, is then taken to the roving frames, where it is further drawn out, twisted and wound on bobbins. The yarn then usually passes to intermediate frames and fine frames, these machines simply supplementing the drawing and twisting processes previously given the yarn.

The final preparatory process is spinning and the capacity of a mill and the grade of its product depends upon these machines. On the spinning frames the yarn is still further drawn out and given its final twist. Spinning is accomplished by either ring or mule frames. In the Southern mills ring spinning is almost exclusively employed.

From the spinning room the yarn is sized and is either taken to the weave room or is shipped to other mills.

General Advantages.

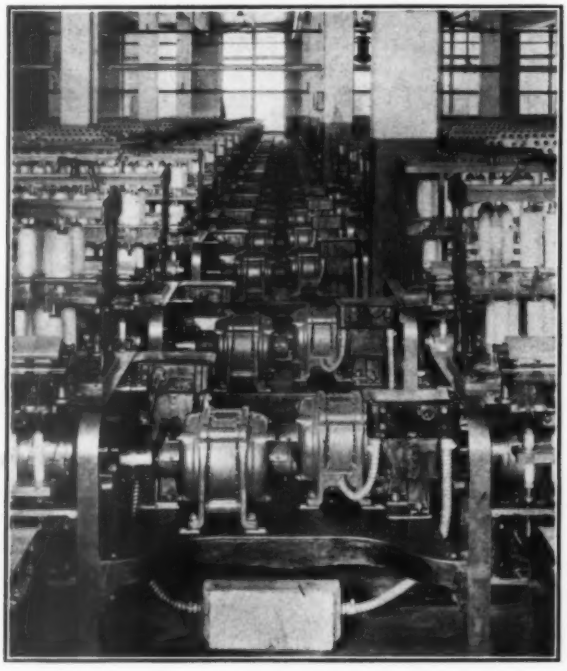
The foregoing outline gives a general idea of the processes involved in cotton-mill operation. The requirements of each of the drives referred to are such as to render electrical operation highly advantageous.

One of the important advantages of electric drive, when power is purchased from the central station, is its reliability. In a cotton mill the continuity of the processes involved makes reliability of driving of prime importance, as a breakdown in any department would affect the entire plant. Little stock is accumulated at any stage of the operation, each department depending upon the previous one for its supply.

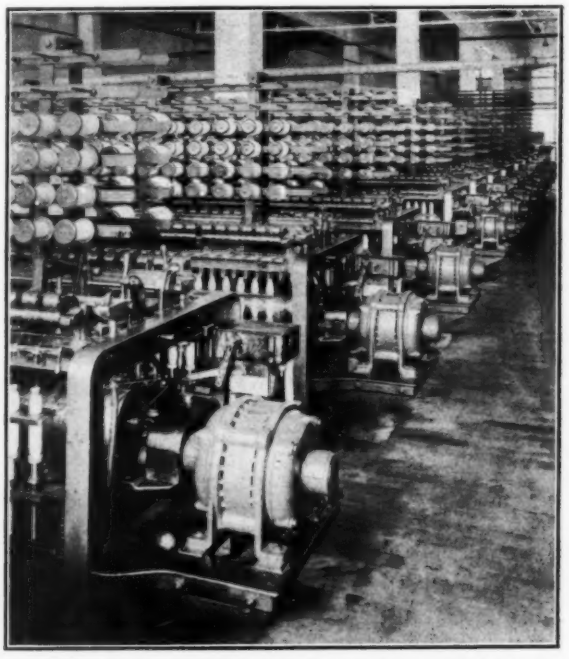
Next in importance is the flexibility of electric power. Whereas the mechanical system of drive offers but limited facilities for enlargement, with motor drive, using central-station service, an extension or extensions to the mill can easily be made without any changes in present driving arrangements or without shutting down any part of the plant. Thus in installing electric drive no provision need be made for more than the immediate requirements.

In a mill converted from steam to electric drive, one of two results is always brought about. If the original production is maintained the amount of power necessary is reduced. This should not in all cases be regarded as of paramount importance, the most vital advantage being an increased product from the mill, which it has been shown can be obtained through electric drive.

In mills only very roughly converted, where surplus power is taken, and where the old uneconomical arrangement is left intact so that the steam drive may be used if desired, all carefully kept records show that an increase of production of from 2 to 10 per cent is obtained. In new mills especially constructed for electric drive the higher of these figures should obtain. This increase is brought about by two things. First, proper balancing of the work, and next, the application of motive power directly to the work it is to drive, and the fact that this motive power has a constant speed value, both instantaneously and continuously.



Five-Horsepower Motors Geared Direct to 256-Spindle Spinning Frames.



Wet Twister Frames Driven by 7.5-Horsepower Motors.

The importance of production may be shown in a broad, general way as follows. The value of a mill's product per annum is about equal to its capital investment. The cost of manufacture, with many variations for the class of work, may be taken proportionately about as follows: cotton, 60 per cent; power, 4 per cent; all other costs, 36 per cent; and the power cost, as a total, is from 3 to 6 per cent of the total market value of the product. Thus, assuming the cost of a 5,000-spindle mill as $100,000, its product in a year will be worth, roughly, $100,000, and its power bill, say $5,000.

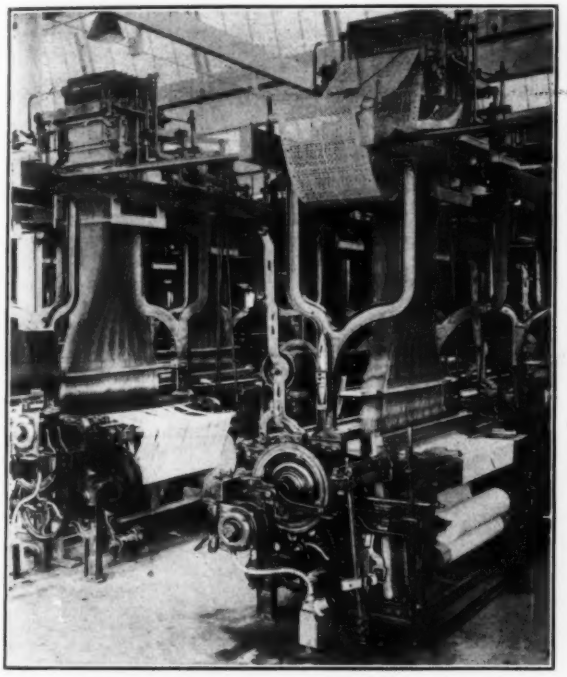
If the product of this mill could be increased 10 per cent the gross value of this increase of product would be $10,000, of which the only cost would be cotton, power and some labor. The most costly operations of labor are paid by the day

and effect no incerase. Allowing, however, for some increased labor cost we have as the total cost of this extra production: cotton, 60 per cent; power, 4 per cent; and labor, 3 per cent, or a total of 67 per cent and a net profit of $3,300 per year, or two-thirds of the total cost of the power, thus nearly eliminating the power bill.

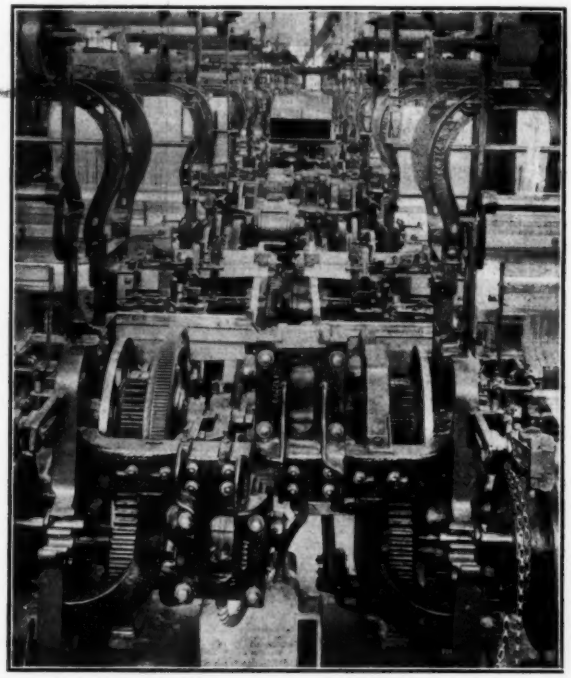
On account of the steadiness of the speed of the electric drive the machinery will suffer less deterioration than if run at even lower speeds with the steam drive.

It is very proper and very necessary to take all of these points into account as having a direct bearing on the cost of steam power.

An interesting application illustrating the flexibility of electric drive has recently been made and is being quite generally followed. In this case a mill was built with a capital of $100,000 and with an equipment of 5,000 spindles for the production of yarns. It was the intention to operate this mill day and night and the promotion of the mill was based on this idea. It was found, however, that for the spinning frames which require women and girls to operate them, sufficiently satisfactory labor could not be obtained to operate during the night run, so that the management found itself in a position of being able to offer to its stockholders a production based only on the actual money employed, or $100,000. Through their own initiative they then took advantage of the opportunity offered by electric drive and added to their equipment an amount of spinning machinery equal to that already installed. This operated with the rest of the equipment during the day time, and all preparatory machinery, for which only men are employed, is operated day and night, thus giving material to the double number of spinning frames during the day. This resulted in a production equal to that of a mill of 10,000 spindles, costing $200,000, while the total cost of the mill was only $120,000. The addition of the extra spinning machinery cost $20,000, and the original cost of the mill was $100,000. This arrangement has, simply by the proper use of electric power, saved the mill an additional burden of investment of $80,000, the interest and also the depreciation on which would more than eliminate the entire power bill.



Jacquard Looms Driven by Individual Motors.



Installation of Individual Motors Driving Looms.

In addition to the foregoing advantages of motor drive, the ease of control is important, owing to frequent stoppages of machines, pickers and looms especially, for replenishing the stock. Also, cleanliness is a point that cannot be exaggerated in its effect upon the quality of the product.

In all textile processes an abundance of good light is essential, especially in the weaving of fine cloth. If the driving mechanism necessitates the use of belts obstructing the light, the quality of the goods may suffer and the output be reduced.

Summarizing, the advantages of motor drive, using purchased power, are: (1) Reduction in capital expenditure, or an equivalent increase in production with the same expenditure. (2) Steadier speed at all loads due to the larger generating sets employed by central stations. (3) Reliability of supply, insured by emergency units in the power station. (4) Freedom from the necessity to watch the coal markets and keep in touch with the improvements in steam plant. (5) Freedom to make extensions or alterations and to operate overtime in any or all departments at a cost proportionate to the power used. (6) Cleanliness, improved lighting conditions, etc.

General Power Requirements.

It is not feasible to give any specific figures on the power requirements for mills, since in no two installations is the selection and arrangement exactly the same. In a general way the approximate power distribution is as follows, however, in mills making medium weight goods. Picking and carding, 16 per cent; spinning, twisting, spooling, warping and beaming, 49 per cent; weaving and slashing, 29 per cent; finishing, 2 per cent; dye house, 2 per cent.

Pickers are perhaps the larest individual power users in a mill. The horsepower required to drive depends upon output and whether the machine is a single or double-beater picker. From 4 to 6 horsepower is usually applied to pickers. These machines are idle about 25 per cent of the time.

Carding machines require about one horsepower each. They are idle about 10 per cent of the time for doffing.

Draw frames require about one-half horsepower per head. These machines are idle about 20 per cent of the time.

The power requirements of slubbers and

rovers vary with the number of bobbins, but averages about two horsepower per frame. About 10 per cent is allowed for stoppage time.

It is hard to specify the power requirements of spinning frames, as so many items have to be taken into consideration, such as speed of spindles, tightness and character of spindle band, humidity, temperature, character of stock, etc. Generally about one horsepower per 70 spindles is taken as an average figure. An allowance of about 10 per cent is made for stoppage.

The power requirements of looms also varies greatly. The power required depends upon the size of the loom, which is determined by the width of cloth, the character of the goods and the construction of the loom. The requirements vary from 0.25 to 2 horsepower per loom.

In considering the nature of the textile load it will be found that a very large proportion of textile machines are required to be run at a constant speed. For this reason the most suitable type of motor is the alternating-current induction motor. This motor has other advantages over the direct-current motor, simplicity and lower first cost being the greatest. The adoption of direct current except in special cases is to be deprecated.

Group and Individual Drive.

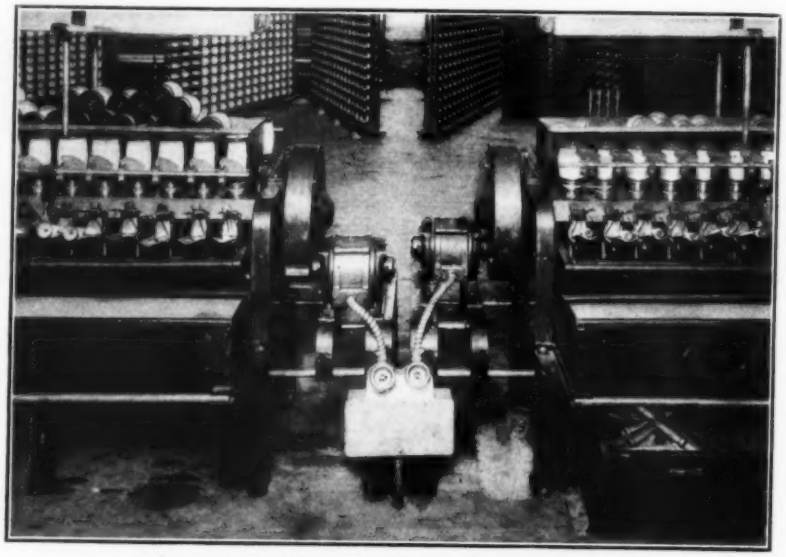
There is considerable difference of opinion between mill enginers as to the relative merits of group and individual drive for cotton mills. Excellent examples of both classes of drive are in existence but the difference between mills makes accurate comparison of the two systems impossible.

The picker drive was originally installed on the group system. The next step was to use individual motors belting directly to the pulley on the countershaft of the picker. This latter drive has many advantages over group drive but it too is being superseded by direct motor drive. In this drive the rotating element is mounted on the picker shaft, pulley fashion, the stationary portion being attached by a suitable bracket to the picker.

For driving carding machines group drive is almost universally used, the practice being to install one motor to drive as many as 75 machines. Should individual motors be applied to cards they would have to be slow-speed machines and while, from an operating standpoint, excellent results could be obtained, the cost of installation would be almost prohibitive.

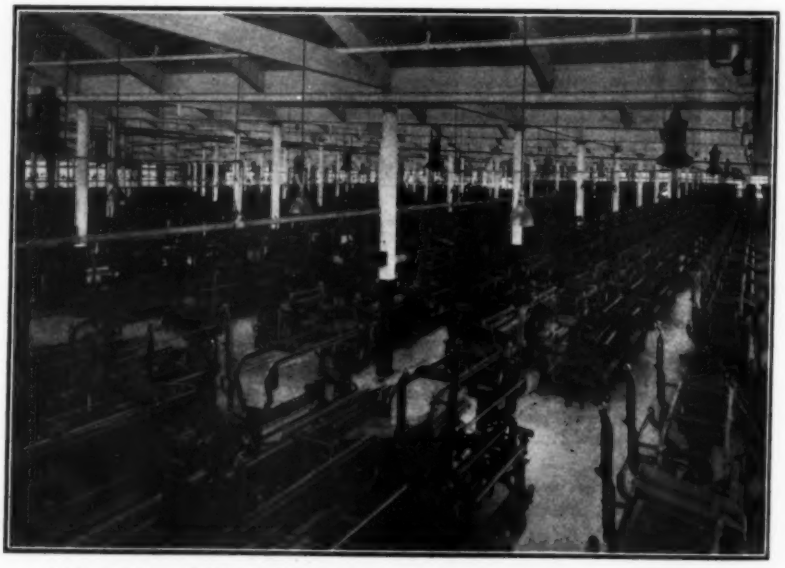
Group drive is used largely for drawing frames, although recently motors are being applied directly to the frames with excellent results. The usual practice is to drive three or four frames from one overhead belt by means of a countershaft located beneath the frame, with a pulley for each frame and a receiving pulley for the end. Individual motors with chain drive are usually preferred.

The direct driving of warpers is another advance made in the application of motors to cotton mills. Two methods of individual drive are in use. In one the motor is mounted on a small platform attached to the side frame directly below the main shaft and geared to it. A gear replaces the tight and loose pulleys. In the second method the same type motor is used, but it is mounted on top of the side frame on two small brackets, and the drive is by chain instead of gear.



140-Spindle Spoolers Driven by 4.5-Horsepower Motors.

In the driving of spinning frames both individual and group drive is being used. In the individual drive the motor shaft is of sufficient length to extend within the cylinder, the end bearing of the latter being omitted. With this system it is impossible to change the speed of the cylinder. Where a change of speed is necessary, the drive is now installed with a silent chain connecting the motor and cylinder, the change of speed being obtained by changing the size of the motor pinion. What is known as the four-frame drive is one of the most popular methods of driving spinning frames. This drive eliminates shafting entirely and still keeps the initial cost down below an installation of individual motors. The drive consists of mounting the motor on the ceiling with sufficient shaft extension on each end to accommodate two pulleys, four frames being driven by each motor.



General View of Weave Room Showing Individual Motor Drive on Looms.

In the accompanying data sheets will be found operating data on several plants using the four-frame drive in the spinning room.

Cotton Mill Data—Sheet No. 1.

The term load-factor is used in these data in such a sense that a load-factor of 100 per cent represents the use for 24 hours every day of power corresponding to the rated capacity of the motors connected. An operating-time load-factor of 100 per cent represents the use of the rated capacity of the motors for the running hours per day specified for each installation.

Plant A. This is a 9,600-spindle, 240-loom mill located in North Carolina manufacturing a medium grade of gingham, exclusively. The average output is 16,800 pounds per week. Running hours per month, 520 (day and night shift).

Total connected horsepower, 551. Total number of motors installed, 27. Average kilowatt-hours per month, 69,158.

Kilowatt-hour consumption for 12 months:

Month	Kilowatt-hours	Month	Kilowatt-hours	Month	Kilowatt-hours
August	65,400	December	68,600	April	74,200
September	75,500	January	48,100	May	80,300
October	67,500	February	66,400	June	63,900
November	73,000	March	85,700	July	61,400

Load-factor, 23 per cent.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is three-phase, 60 cycle, 2,200 volts and 550 volts.

No.	Horse-power.	Speed R. P. M.	Application
			550-VOLT SERVICE.
2	3	1,800	Each belted direct to opener.
2	5	1,200	Each belted direct to breaker picker.
2	5	1,200	Each belted direct to an intermediate picker.
2	5	1,200	Each belted direct to finishing pickers.
1	5	1,200	Belted to line shaft driving machine-shop equipment.
1	5	1,200	Driving 4,000-pound-capacity elevator.
1	10	1,200	Belted to line shaft driving two 1,500-end warpers; and four 100-spindle spoolers.
1	15	1,200	Belted to line shaft driving beamers; brusher; and one baling press.
			2,200-VOLT SERVICE.
1	40	900	Belted to line shafting driving 30 cards.
1	60	900	Belted to line shafting driving 12 draw frames, five deliveries each; four slubbers, 84 spindles 12 by 6 inches; and six speeder frames, 164 spindles (8 by 4 inches) each.
4	25	1,800	Each belted to four 240-spindle filling spinning frames.
6	25	1,800	Each belted to four 240-spindle warp spinning frames. These 25-horse-power motors are of the four-frame-drive type.
1	50	900	Belted to line shaft driving 144 looms.
1	50	900	Belted to line shaft driving 96 looms.
1	30	1,200	Belted to line shaft in dye house driving extractor.

Energy is supplied by the Southern Power Company.

Majestic Cotton Mills, Belmont, N. C. This is an 18,240-spindle mill producing twisted yarns ranging in size from No. 70 to No. 120. Sea Island and Egyptian cotton is used. The average weekly output is 9,000 pounds. Running hours per week, 120.

Total connected horsepower, 516. Total number of motors installed, 27. Average kilowatt-hours per month, 99,641.

Kilowatt-hour consumption for 12 months:

Month	Kilowatt-hours	Month	Kilowatt-hours	Month	Kilowatt-hours
January	96,730	May	103,430	September	102,490
February	88,830	June	105,240	October	108,390
March	89,510	July	109,170	November	103,950
April	93,480	August	95,700	December	98,780

Load-factor, 35 per cent.

MOTOR INSTALLATION.

The folowing is a list of the motors instaled with their respective drives. The supply source is three-phase, 60 cycles, 2,200 volts.

No.	Horse-power.	Speed R. P. M.	Application
1	12	1,145	Belted direct to suction conveyor.
1	12	1,145	Belted to line shaft driving one single-beater opener picker; one intermediate picker; and one finishing picker.
1	20	1,150	Belted to line shaft driving 20 cards.
1	30	1,160	Belted to line shafting driving one ribbon lapper; one sliver lapper; 10 combers, eight heads each; four draw frames, 6 deliveries each; and two slubbers, 60 spindles each.
1	20	1,200	Belted to line shaft driving 10 fine frames, 200 spindles each.
20	20	1,150	Each motor belted direct to four spining frames, 228 spindles each.
1	12	1,145	Belted to line shafting driving eight spoolers, 100 spools each; four doubling spoolers, 100 spools each; six Universal winders, six ends each; two warpers; one Foster winder, 100 spindles; and eight 50-spindle reels.
1	10	1,200	Driving pumps.

Energy is supplied by the Southern Power Company.

Cotton Mill Data—Sheet No. 2.

Imperial Cotton Mills, Belmont, N. C. This mill manufactures twisted yarn for knitting mills, the average size being No. 72. The average output is 9,500 pounds. Running hours per week, 120.

Total connected horsepower, 500. 7 motors. Average kilowatt-hours per month, 168,433.

Kilowatt-hour consumption for 12 months:

Month	Kilowatt-hours	Month	Kilowatt-hours	Month	Kilowatt-hours
June	153,000	October	176,200	February	165,300
July	164,300	November	173,600	March	175,400
August	151,200	December	176,500	April	170,000
September	164,600	January	176,700	May	174,400

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is three-phase, 60 cycles, 550 volts. Load-factor, 61 per cent.

No.	Horse-power.	Speed R. P. M.	Application
1	50	850	Belted to line shafting driving one suction conveyor; one breaker and picker; two intermediate pickers; and two finishing pickers.
1	50	850	Belted to line shafting driving 24 cards; nine combers, of eight heads each; one sliver lapper; one ribbon lapper; and four draw frames, of four deliveries each.
1	50	850	Belted to line shaft driving two 60-spindle slubbers; four first intermediate spinning frames, 60 spindles each; four second intermediate frames, 142 spindles each; and 12 jack frames, 176 spindles each.
2	100	690	Each driving 24 frames of 216 spindles each.
1	50	900	Belted to line shafting driving eight wet twister frames, 216 spindles each; and five spooler frames of 120 spools each.
1	100	690	Belted to line shaft driving 18 twister frames, 216 spindles each; one spooler, 120 spindles; one Foster winder, 100 spindles; six Universal winders, six ends each; and eight reels, 40 spindles each.

Plant in South Carolina equipped with 10,240 spindles, manufacturing a fine grade of sheeting. The average weekly production is 13,000 pounds. Running hours per week, 60.

Total connected horsepower, 910. 27 motors. Average kilowatt-hours per month, 158,333.

Kilowatt-hour consumption for 12 months:

Month	Kilowatt-hours	Month	Kilowatt-hours	Month	Kilowatt-hours
June	158,800	October	163,100	February	180,400
July	119,800	November	181,100	March	190,400
August	129,900	December	177,000	April	167,600
September	161,300	January	173,100	May	177,500

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is three-phase, 60 cycles, 550 volts. Load-factor, 31 per cent; operating-time load-factor, 66 per cent.

No.	Horse-power.	Speed R. P. M.	Application.
1	75	700	Belted to suction conveyor and condenser; three openers and breaker pickers; three intermediate pickers; and three finishing pickers.
1	100	700	Belted to line shafting driving 48 cards; and 16 draw frames, six deliveries each.
1	100	700	Belted to line shaft driving six slubbers, 60 spindles each; 10 intermediate slubbers, 90 spindles each; and 20 fine frames, 8 by 35, 160 spindles each.
10	20	1,700	Each driving four filling spining frames, 256 spindles each.
10	25	1,700	Each driving four warp spinning frames.
1	10	1,160	Belted to line shaft driving warp frames; six spoolers, 120 spindles each.
1	50	850	Belted to line shaft driving 160 36-inch looms.
1	100	700	Belted to line shaft driving 400 36-inch looms.
1	25	1,150	Belted to line shaft driving one suction fan; two slashers; one size kettle; two sewing machines; two calanders; two brushes; two folders; and one press.

Cotton Mill spinning No. 24 yarn. Average weekly output 18,000 pounds operating 120 hours per week.

Total connected horsepower, 140. 3 motors. Average kilowatt-hours per month, 24,702.

Kilowatt-hour consumption for 12 months:

Month	Kilowatt-hours	Month	Kilowatt-hours	Month	Kilowatt-hours
January	25,510	May	21,500	September	27,490
February	23,220	June	21,730	October	26,520
March	24,340	July	20,900	November	21,550
April	25,450	August	24,270	December	23,910

MOTOR INSTALLATION.

The following is a list of the motors installed wiwith their respective drives. The supply source is three-phase, 60 cycles, 2,200 volts. Load-factor, 32 per cent; operating-time load-factor, 34 per cent.

No.	Horse-power.	Speed R. P. M.	Application.
1	60	720	Belted to line shafting driving one opener breaker and picker; one intermediate picker; one finishing picker; 14 cards; four six-delivery draw frames; two slubbers, 40 spindles each; one intermediate frame, 180 spindles; one intermediate frame, 72 spindles; and five fine frames, 144 spindles each.
1	40	900	Belted to line shaft driving 12 216-spindle spinning frames.
1	40	900	Belted to line shaft driving 10 spinning frames, 216 spindles each; four reels, 50 spindles each; and two Foster winders, 100 spools each.

Mill Lighting.

The elimination of the countless belts and shafting made possible by the application of electric motors to cotton-mill machinery improves the natural lighting conditions to such an extent that artificial lighting is of secondary importance during day operation, that is, if proper consideration has been given to the design of the buildings themselves. However, as most mills operate a night shift, the design of the lighting system is of the utmost importance if the night production is to equal the day production in quantity and quality.

The textile industry is of such a nature that many processes can be accomplished by means of general illumination entirely. The receiving room of the cotton mill, wherein the bales of cotton are opened and cleaned, need be provided only with a general illumination of moderate intensity of from 2 to 3 foot-candles.

A low intensity of illumination of from 1 to 2 foot-candles is required for opening or lapping. This may be supplied by general illumination or by localized general illumination wherein 40-watt tungsten-filament lamps with extensive reflectors are used. In the carding room best results are obtained by installing 40-watt tungsten-filament lamps with extensive steel reflectors, using one lamp per machine. Lamps are usually staggered and suspended 7 to 8 feet above the floor over the aisles.

Combing machines are difficult to protect and a careless operator is somewhat liable to injury, particularly if there are shadows cast by the light source. Localized general illumination is recommended for combing machines with an intensity of from 3 to 4 foot-candles.

For drawing and roving frames general illumination of low intensity is advisable. In the case of the former, two 40-watt tungsten-filament lamps in extensive reflectors per frame, spaced 8 feet apart give the best results. For roving frames, three 40-watt lamps are usually placed in the aisle, spaced 7 to 10 feet apart and suspended from 7 to 8 feet above the floor.

The spinning operations in the cotton mill should be performed under localized-general or general illumination of 2 to 3 foot-candles. For localized-general illumination lamps should be in the aisle between the frames. Three 40-watt tungsten-filament lamps spaced on 7 to 10 foot centers and hung 7 to 8 feet above the floor give the desired results. Extensive steel reflectors should be used.

For warping an illumination of from 3 to 5 foot-candles is recommended. This is best accomplished by placing one 40-watt tungsten-filament lamp with extensive reflector over the beam and one 40-watt lamp with intensive reflector over or inside reed rack. When warpers are movable use general illumination.

For illuminating the slasher the best practice is to place one 40-watt tungsten-filament lamp with extensive reflector at each end of the machine, hung about 8 feet above the floor.

In the cotton mill weaving light goods the illuminating intensity recommended is 2 to 4 foot-candles. With localized-general illumination this intensity can be secured with a 60-watt tungsten lamp in an extensive reflector suspended at the intersection of the weave alley and the aisle between alternate machines. For weaving 74-inch goods, a single 40-watt lamp in an extensive reflector suspended at the end of the weave alley, between each pair of machines, will accomplish the same results. For weaving dark goods, a lighting intensity of from three to five foot-candles is required. This is accomplished under localized-general illumination by means of the same arrangement as given for lighting color goods, excepting that the next larger size lamp is used.

Commercial Practice
Management, Rates, New Business

Electricity in Building Construction.

The adaptation of the electric motor to the machinery used in this class of work offers so many advantages over any other method previously adopted that its use is becoming almost universal by the building contractor for hoists, concrete mixers, pumps and air compressors, says F. C. Hard, in *Edison Life*.

From the time of excavating for the foundations to the cutting and placing in position of granite or marble walls and wainscoting in the completed structure, electricity is depended upon to furnish reliable power for the countless operations necessary. This class of power service is fast increasing.

Many of the manufacturers of hoisting apparatus are now building and offering for sale a motor-driven hoist equipped with all the "single and double drum" appliances formerly used on the standard type of steam hoist. The ease with which electric power can be transmitted any distance to any location within a building makes the electric hoist independent of such requirements as coal or water supply necessary with the old-time "donkey."

The stability of any structure is dependent upon its foundation. Speed and efficiency are important factors in this part of the work, and it becomes necessary for the contractor to provide some effective and rapid method of reaching bed rock.

As is frequently the case, excavation is done in the congested business district, where the use of the usual type of steam digger is objectionable. It is both noisy and smoky. A modern electric shovel is excavating for the foundation of one of the new buildings of the Brigham Hospital in Boston. Three-eighths of a cubic yard of soil is taken out with each scoop of the shovel. Electric service fulfills every requirement as to reliability, flexibility and adaptability.

After the giant frames have found their resting place, it becomes necessary, of course, to secure them firmly and solidly. Thousands of rivets must be driven and headed, and for this work the somewhat noisy but effective "air tool" is brought into use. Motor-driven air compressors furnish a constant and plentiful supply of energy for riveting purposes. They did effective work on the Filene Building and the Copley Plaza Hotel.

Water, the bugbear of the contractor, must be kept out of the foundation excavations and a very simple and effectual method of accomplishing this is by the use of a motor-driven pump, usually of the centrifugal type. It is often automatically controlled and can absolutely be depended upon to free the excavation from water, operating, as it does, without care or attendance for several days at a time.

Motors attached to portable marble cutting and drilling tools were in use in some recently completed buildings for which the walls and wainscoting material were cut and fitted on the job.

Elevator contractors have applied electric motors to machinery for driving the deep shaft pits necessary for the plunger type of elevator.

Motor-driven table saws (for cutting

joists and timber) are moved about from floor to floor as the work on the structure progresses. Electric sanders, not unlike a lawnmower in appearance, are moved over the hardwood floors, sanding and polishing them to almost mirror-like surfaces.

One of the important accessories is the concrete mixer. Good work is accomplished speedily and economically. One 25-horsepower machine at work on the City Hall Annex has a capacity of 16 cubic yards per hour.

The saving of time and labor are two very important factors in modern building construction. The progressive building contractor, always striving to accomplish both, finds that electric power, with its greater flexibility, its convenience and efficiency, will help him to produce the desired results. And the manufacturer, alert to the demand of the time, is lending his efforts to solve the problem of the contractor.

A Model Home.

The department store of Jordan Marsh Company in Boston is exhibiting a model electrically heated and lighted home, a suite of six rooms and hall, furnished with antique furniture and oriental hangings. It is fitted with all electric devices of use in the modern household. The library has Mazda reading lamps and a radiator. In the dining room are shown electric toasters, chafing dishes, food warmers and coffee and tea pots. The sleeping room has warming pads for the bed, a massage vibrator, curling irons, heating box for infants' milk bottle, and a vacuum cleaner. The kitchen is equipped with a stove and a table that has four connections, making possible the use of several electric devices at one time. There is also a power table where egg beating, ice-cream freezing and meat chopping may be done without the expenditure of muscular energy. The laundry is electrically operated throughout, there being electrically equipped washing machines, wringers, mangles and flatirons. The company plans soon to open a department for the sale of electrical devices, the demand in Boston having greatly increased since the Boston Edison Company's adoption of a three-cent rate for heating and cooking.

A Window Attraction.

A unique window trim was recently used by the Kentucky Electric Company, Louisville, Ky. Widespread argument before the window was caused as to what made a little ball suspended in mid-air gyrate so freely and dash madly up and down a 10-foot orbit. Divers and sundry arguments, all more or less ridiculous, were offered in explanation of the phenomenon.

The ball was really riding upon a jet of air from a moving air-pump, operated by an electric motor beneath the platform, but the simple device focussed the attention of thousands of passers-by upon the Ky-El-Co, and that is what the central-station men were after.

Reduction in St. Louis Rates.

In keeping with its policy of selling electric service as cheaply as conditions warrant, the Union Electric Light & Power Company of St. Louis has again materially lowered its rates for commercial electricity. This reduction has been effective since December 1. The Union company mailed to each of its commercial consumers a circular letter announcing the decrease and requesting that all of them apply for the new and lower rate, provided it should not be higher than that charged them under their existing contracts. A card on which this application could be made was inclosed.

This method of advertising the new rate and giving its customers the benefit of it was adopted by the company because of the fact that there are several different schedules, and the consumer's consumption is taken for a year and figured on the basis of the various schedules to determine which of them will insure him the greatest saving.

Of the 7,000 customers who had responded to this proposal up to January 15, about 90 per cent were greatly benefitted by the new rate. To those who failed to apply for the reduction the company recommends prompt action in order that the new rate may be put into effect as quickly as possible.

Reaching the Prospect at the Opportune Time.

Presenting your "proposition" to the prospect at the opportune time is responsible for many signed contracts that would otherwise be lost, particularly if competition is a factor. A realization of this was responsible for the ingenious method devised by Thomas B. Rhodes, commercial manager of the Consumers Electric Light and Power Company of New Orleans, La., for directing the attention of prospective customers to the facilities of his company.

The policy of New Orleans papers of publishing details of building permits granted each day gave Mr. Rhodes the incentive for his scheme. These items are clipped from the papers and pasted on attractive two-color cards containing the following inscription: "The Consumers Electric Light and Power Company of 614 Canal Street would appreciate an opportunity of figuring on your electrical requirements." These cards are then mailed to the persons to whom the permits were granted. The company states that replies are received from a large proportion of the cards mailed.

Electric Sign Progress in Galveston.

About one year ago the campaign for making Galveston the best lighted city in the world was begun, and the city of Galveston, it is claimed, now has more electric display advertising signs to the mile, street or in any other manner figured, than any city of similar size. During the year between 85 and 100 electrical displays have been installed in various sections of the city. Of this number the Brush Electric Company, who inaugurated the move of making the Oleander city the best lighted city in the country, has installed more than 80, the Galveston Electric Company putting in the remainder. The signs, which represent an investment of more than a hundred thousand dollars, are of sundry designs and mechanism, some of them being among the very finest ever constructed, as well as the largest. There are more than 27,000 electric lamps in these signs. Among the many signs installed during the past year are seven which contain 800 lamps or more. The slogan sign, located on the seawall on an indestructible concrete base, represents one of the most beautiful designs ever put into execution, and contains 5,000 brilliant tungsten lamps. The Gas and Electric Building, the home of the Brush Electric Company, which has been so instrumental in making the city a blaze of electric lights, is outlined in 3,000 lamps.

Ornamental Street Lighting for Charlotte.

Plans are being formulated by the Charlotte Electric Company, Charlotte, N. C., in conjunction with the local commercial club to install a comprehensive ornamental street-lighting system in the business district. The plans provide for converting the trolley poles already installed to conform to the posts that will be installed between them so as to make the installation uniform in appearance. The trolley poles will be equipped with four arms, each supporting an up-turned 100-watt tungsten-filament lamp. Each lighting post will contain five 100-watt lamps.

All installation work will be done by the company and the city will pay for the energy consumed.

New Orleans Company Moves Offices.

The Consumers Electric Light and Power Company, New Orleans, La., will move its offices on February 1, from 139 South Rampart Street to 614 Canal Street. This change, made necessary by the increasing business of the company, provides for a completely equipped display room where a comprehensive line of electrical goods will be carried. The new offices are centrally located.

Advantages of Central-Station Power During Flood.

The many advantages of electric power supplied through individual motors in a factory in time of emergency were conclusively demonstrated in Louisville, Ky., during the mid-January flood. The expected rampage of the Ohio River came about the fifteenth of the month, the waters reaching a stage of 39.6 feet at the falls, nearly equaling the record mark established during the winter of 1884.

Owing to the excellent offices of central-station power, however, the effect of the recent flood was nullified on "the Point," that section of the city most easily submerged in the event of a rise in the river, but nevertheless densely populated with industrial plants because of the excellent river and rail transportation facilities it affords.

The Louisville Veneer Mills, located there, lost less than half the time which it ordinarily would have lost, owing to the efficiency of the individual motor installation, enabling power to be supplied to upper floors of the mills, even though the flood stood six to ten feet deep on the ground. The Booker Box Company, operating its plant throughout with individual motors, practically eliminated its time loss, and all departments except the picker-room of the Louisville Girth & Blanket Company, a concern subjected to the invasion of back-waters from the river, were enabled to run without the loss of an hour's time when the flood was at its worst.

Large Sign for Milwaukee.

A mammoth electric sign has been erected on the roof of the Majestic Building in Milwaukee, Wis. The sign will consist of the single word "Gimbels" to advertise the department store of that name. The sign is 150 feet long and 54 feet high; each letter is 34 feet high. The total weight is about 16 tons. Ten thousand feet of copper wire were used in wiring the letters. The total candlepower installed is about 32,000 and the cost of operation is estimated at $10,000 annually.

Record Established for Louisville Lighting Company.

Standing high up in the long list of electric utilities owned by H. M. Byllesby & Company, of Chicago, the Louisville Lighting Company, of Louisville, Ky., is justly proud of the record which it made during the third week of January. At that time the records of the company indicated an increase of 17 per cent in the connected load of the station, as compared with the connected load of the corresponding week in 1912. This expansion, coming at this time of the year, constitutes an unprecedented and unexpected total for the Louisville company.

An Electrically Purified Water Plant.

The Baltimore County Water & Electric Company, in Maryland, has built a plant at their Herring Run Station for electrically sterilizing the water in that locality.

This method requires only about one-tenth the area needed for rapid sand filtration and was adopted after the various methods of filtration and the use of alum and hypochlorite of lime had been tried.

The plant consists of a raw-water chamber, aspirator heads, ozone chambers, ozone generator and a time-contact basin or mixing cell.

The ozone generator consists of a boiler-plate shell and head 30 inches high and 33 inches in diameter. In this shell are a large number of aluminum tubes containing micanite tubes which serve as insulators for metallic tubes connected to one terminal of a transformer. The other terminal of the transformer, which gives from 10,000 to 15,000 volts, is connected to the ozone generator shell.

When the circuit is closed, a continuous violet discharge occurs between the inner and outer tubes, producing ozone in the air passing through. By means of the time-contact basin or mixing cell the water is made to move horizontally as well as vertically in contact with the ozone so as to give it a long time of action.

Current is supplied to the transformer at about 2,000 volts, and there is a separate five-kilowatt transformer for each mixing cell or basin. The capacity of each basin is 1,000,000 gallons of water in 24 hours.

Twin Falls Plant Started.

The plant of the Peninsular Power Company, at Twin Falls, Mich., on the Menominee River, has been completed and the power has been turned on. The enterprise represents an expenditure of almost $1,000,000. The plant as now equipped is capable of generating 3,600 horsepower, but the plant is so arranged that an additional 2,400 horsepower can be developed when needed.

Besides the water power, the company has an auxiliary steam plant at Iron River, Mich., capable of developing 700 horsepower. The plant lights the city of Iron Mountain, Mich., and has contracts to supply electrical power for a half-dozen big mining companies in the vicinity.

Use of Electric Power in Swiss Factories.

The use of electricity as motive power in Swiss factories is shown by a recent government report to have largely increased. In 1911, 84.7 per cent of the factories had adopted it. In the district around St. Gall, the great center of embroidery production, electricity is almost exclusively employed for power.

Mobile's Principal Residence Street to Become a Great White Way.

As soon as definite arrangements can be made, a "white way" system, extending for a distance of about two miles, will be installed on Government Street, Mobile, Ala.

This movement was started by one of the local newspapers and met with favor among the property owners. It is planned to have the lighting system cover both sides of the street, making a total distance of 21,384 feet to be illuminated.

Tentative plans for the lighting of Government Street call for the installation of 170 five-light standards, posts to be erected 133 feet apart with four posts at each street intersection. The estimated cost of the system is $30,000.

Mobile merchants have also interested themselves in a "white way" system for the downtown district. Both these systems will be elaboration of the white-way lighting installed in Bienville Square some time ago through the efforts of the Mobile Electric Company.

Change of Management at Sedalia.

One of the significant phases of the acquisition of the Sedalia (Mo.) Light & Traction Company by Henry L. Doherty & Company was the liberal use of newspaper space in advising the public of the changes made. In a preliminary advertisement the company requested that its advertisements be watched for announcements relative to new policies to be inaugurated and plans for future betterment. Subsequent ads explained in detail what the new policies were going to be; how the service was going to be improved; etc.

One of the early advertisements was given over to a brief sketch of the career and duties of each of the new officers of the company with a request that the public make an effort to meet each personally. Co-operation between company and customer was the keynote of each ad of the campaign.

Profiting by Christmas Accidents.

In a St. Louis newspaper of December 30 the Union Electric Light & Power Company, St. Louis, Mo., inserted an effective advertisement to emphasize the safety of electric illumination of Christmas trees. Newspaper headings relating to many Christmas-tree fires and accidents due to burning candles were reproduced in the advertisement from which the evident deduction was drawn that along with its other advantages safety could be emphasized for electric lighting.

Electrical Construction

CONCERNING CUTOUT CABINETS.

By Russel H. Eddy.

In the usual course of knob-and-tube wiring the cutout cabinet is built into the wall of the house which is being wired by putting in headers between studdings, furring up the opening, and then lining with asbestos. This arrangement leaves any and all sizes of openings to be incased and covered with doors. Each wireman builds his cabinet to suit his own fancy, as a rule, and usually forgets to keep a record of the dimensions of the opening for which the door is to be made, or, if he does keep such a record, he is quite liable to forget to turn it in at the proper time. Then when the job is ready for the finishing touches—in the town where the writer works no lights are allowed to be turned on until the work is finished—another workman is sent out, who, after completing everything but the cabinet door and trim, takes the measurements for the door and brings or sends them to the shop. The shop orders the special door needed from the mill or from some carpenter, and finally has to have a man make an extra trip to the building to install it. Thus this lack of standard practice in the matter of such cabinets is almost sure to result in what is really an unnecessary loss of time and money.

In order to avoid such unnecessary loss, the workmen whom the writer employs are instructed to follow certain dimensions which are considered standard in our shop. Consider, for example, a house having eight rooms, and in which fewer than 36 lamps are to be installed. Our rule is that the cabinet opening must be 12 by 12 inches, and arranged to take a standard entrance switch and three two-wire single-branch cutouts and allow for a two-inch slope at the bottom of the cabinet, there being left a working space 12 by 10 inches on the back surface.

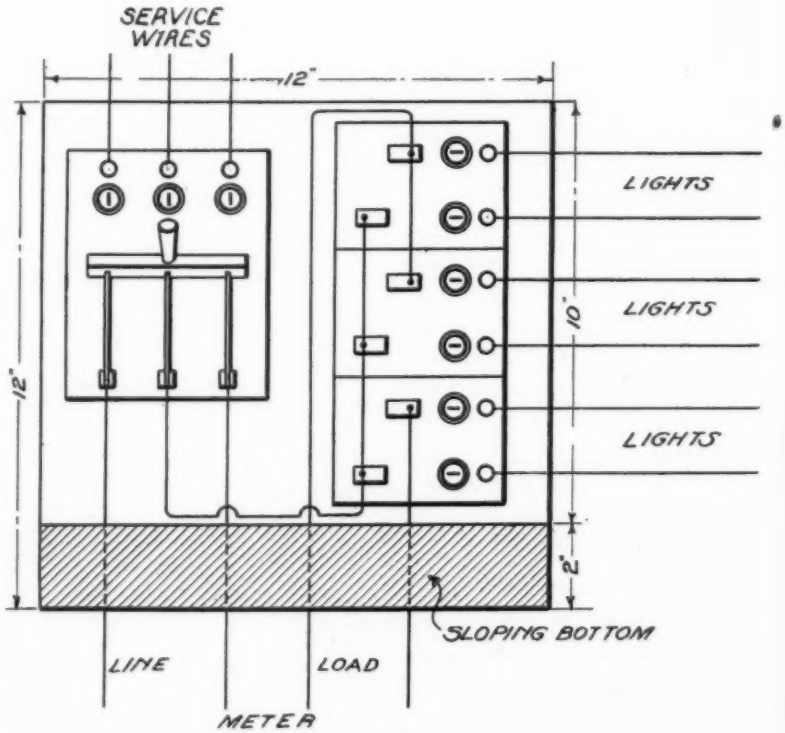
The next three sizes for cabinets are 12 by 15, 12 by 18, and 12 by 24 inches, respectively, the dimension given being intended to be applied to cased openings. It will be noted that the dimension 12 inches is retained throughout; this is necessary because carpenters do not always allow 14 inches between studdings.

By following this system, we find it convenient to order cabinet doors and trim by the hundred, and to get them for about half the price they formerly cost us.

This matter of following systematic plans in the installation of cutout cabinets is something the electrical contractor can ill afford to neglect. A properly installed cabinet, with neat door and trim, and with the wires running directly out from the connections, and the contractor's nameplate on the door is a standing advertisement for future business.

It is highly desirable that cabinets be built in the shop, and there lined, fitted, and connected up with three service wires, each slightly more than eight feet long coming out at the top, and a meter loop at bottom. When delivered to the workman on the job in this shape, the cabinet can be installed without loss of time. Building cabinets in the shop prevents waste of material, saves time and insures a better grade of work than it is reasonable to expect when they are built at the house where they are to be used.

In the accompanying figure the arrangement of cabinet and cutouts which the writer prefers is indicated. The panel door is 12.5 by 12.5 inches, forming a half-inch rabbet with the casing, against the ground strips and plaster. The cabinet is three inches deep in the clear. For casing, four inches is allowed, and there is one-inch clearance for the wires. Meter wires should be 18 to 24 inches long. If neutral wire is required for the meter, it should be looped under the central contact on the service switch and then dropped through bottom to the meter outlet.



Arrangement of Cabinet.

[Would it not be better to purchase standard, approved cabinets already built?—Editor.]

There are said to be 1,372 feet of wire in a 16-inch fan, and 750 pieces of material enter into its construction.

SOME INTERESTING UNDERGROUND CONSTRUCTION.

Installation for Street-Lighting Service in Dubuque.

The advantages of underground distribution for supplying electric power in the crowded sections of cities and large towns, and in public parks and the more fashionable residence districts are already so well appreciated that any considerable amount of comment upon them would doubtless be a needless waste of time. Moreover, underground construction has much to commend it for use in even the smaller towns and its adoption in places of this sort seems to be constantly increasing. Aside from the gain in the appearance of the streets which placing the wires underground makes possible, it greatly simplifies distribution on streets along which trees grow thickly and results in other advantages too obvious to need to be enumerated.

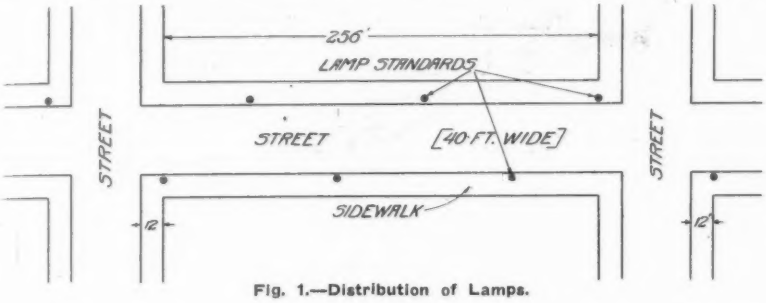


Fig. 1.—Distribution of Lamps.

A condition which has tended to retard an even more general adoption of underground distribution has been a lack of familiarity on the part of electricians with this kind of construction. As the writer has seen it, much of the work that has been installed outside of the largest cities has been interesting mainly because of its crudeness and lack of dependableness. There has been altogether too much of a disposition to adopt such construction as the running of wires in a low grade of iron pipe, with sometimes a single alternating-current conductor in the pipe, instead of simplifying matters and insuring really first-class service by employing standard materials designed by specialists and shown by experience to be satisfactory. This condition, it is believed, is of itself sufficient to make the following description of a modern installation of value.

The installation which is the subject of these notes was recently put in for supplying current to arc lamps on some of the streets of the city of Dubuque, Iowa. It was designed by M. R. Lash and the work was done under his direction by the E. P. Smith Electric Contract Company, of Dubuque.

The lamps, which are magnetite arcs and which were supplied by the General Electric Company, are hung on iron standards of a modern, attractive design, spaced as indicated in Fig. 1. They are connected in series, of course. When the installation is complete there will be a total of 56 of these. They will be operated on two circuits, each designed for 4,000 volts and each controlled by a separate rectifier panel in the station of the Union Electric Company, which is the central station furnishing service in the city mentioned.

Fig. 2 tells a large part of the story of the installation of the conductors which make up these two circuits. A single-conductor cable laid in a trench in the manner indicated is used, this cable being Safety steel-taped cable, which is manufactured by the Safety Insulated Wire & Cable Company. Each cable contains a central No. 6 rubber-covered copper wire. The wire is first taped and then laid up with jute, after which a second layer of tape and a lead covering are added. Outside the lead covering there is a second layer of jute; then two layers of steel tape wound spirally on one another and arranged so that the outside layer covers the joints between adjacent spirals of the inner layer; and finally the outer surface of the steel tape is covered with asphalted jute. The cables employed were designed for a pressure of 5,000 volts.

It is customary to lay cables of this type in a narrow trench in the ground and fill the trench with dirt. In order to maintain the structure of the paving of the street uniform, however, it was necessary in the installation under consideration to lay the cable in cement. Paving bricks enough were taken up for a trench the width of a spade and a trench 10 inches deep was made along the edge of the street close to the curbing. This depth carried the trench four inches into the concrete of the paving. In the concrete itself the trench was only made wide enough to accommodate the cable. When the cable had been laid, the street was restored to its former condition by putting in a layer of concrete first and then adding the sand and bricks which had been removed.

In running the cables from the trench to the bases of the lamp posts along the curbing a hole was cut through the concrete of the sidewalk large enough to accommodate an auger which was used to bore out a raceway between the lamp post and the trench. Then to a fish-wire run through this opening the ends of the two cables were attached and the conductors drawn in.

Room was left in the bottom of each lamp standard for the installation of an absolute cutout if it should ever be decided to install this. As the work which has been finished now stands, however, the lamps are connected directly through No. 8 wires properly incased in flexible

Fig. 2.—Installing 5000-Volt Steel-Taped Cable.

fiber tubing and spliced to the conductors in the cables.

A particularly interesting fact about this piece of work is that the cables were laid in zero weather. In fact the temperature was sometimes as much as four degrees below zero. It was necessary to thaw out the street by burning cordwood saturated with kerosene along the path of the trench before the digging could be done. But in spite of such weather conditions as this, two blocks of lighting were installed complete in eight days with a force of but eight laborers and two electricians.

While Figs. 3 and 4 show nothing concerning the installation of the circuits directly, they are interesting as showing the improvement in street illumination and the good appearance of the street where the lamps have been put in operation. It is interesting also to note, in conclusion, that the money for this installation was furnished by the enterprising owners of the property along the streets to be lighted. The bills for power will be paid by the tenants.

Fig. 3.—Old System of Lighting.

Fig. 4.—New Lighting With Magnetite Arc Lamps.

New York State Electrical Contractors' Association.

At the annual meeting of the New York State Electrical Contractors' Association, held in Syracuse, N. Y., on January 21, officers for the current year were elected as follows: president, F. W. Newman, Albany; vice-president, H. N. Smith, Syracuse; secretary, G. W. Russell, Jr., New York; and treasurer, J. P. Burn, Schenectady.

Licenses for Theater Operators.

That all moving-picture operators in Paducah, Ky., be licensed and duly qualified as to their fitness for their positions, is the demand made by Patrick Coyne, electrical inspector in that city. It is the belief of Mr. Coyne that experienced operators who are able and willing to stand tests of their skill will go far toward minimizing the fire and public-danger hazard existing in the popular amusement resorts.

Peoria Requires Licenses of Electricians and Contractors.

While the municipal electrical inspection rules now in force in Peoria, Ill., are not entirely new to that city they do contain enough that is different from the rules of other cities to make them interesting. The city electrician in Peoria, as is the case in many of the smaller cities, is also the chief electrical inspector; but the city ordinance which created the department of electricity provided a sufficient staff of assistant inspectors.

Before any electric wiring may be done in the city a permit covering the work to be installed must be secured from the commissioner of buildings of the city, which permit must be in writing and must give the location of the work to be done and also describe it briefly. As is generally the case, it is unlawful for any person or firm to make use of an installation of electric wiring before the installation has been inspected and passed, and any person or firm engaged in selling electric power is adjudged guilty of a misdemeanor and is subject to fine if it connects its service to electric wiring which has not passed inspection, or, at least, until permission to make such connection has been obtained from the city electrician. When an inspection has been made and the wiring found to be satisfactory a notice to that effect is placed at the service switch or at some other convenient point. It is unlawful to conceal electric circuits until they have been inspected.

The penalty for concealing circuits not inspected and approved, or for installing wiring without a duly signed permit, or for connecting service to wiring not inspected is a fine of not less than $5 nor more than $25 for each offense.

For issuing a permit for electric wiring the fee is 50 cents where there are 100 outlets or fewer than this; for each additional hundred outlets or fractional part thereof there is a charge of 50 cents. The fees for the inspection of wiring are as follows: from 1 to 25 outlets, $1, with an additional charge of 50 cents for each additional 25 outlets or fractional part thereof. All places where wires end, as at switches, brackets, etc., are considered outlets.

For the inspection of fixtures, signs, etc., of from 1 to 25 sockets or receptacles there is a charge of $1, with 50 cents additional for each additional 25 sockets or fractional part of this number. Arc or other lamps consuming 3 amperes of current or more are charged for at the rate of $1 for the first lamp and 50 cents for each additional lamp. The fees for inspecting motors, generators and other similar appliances is $1 for machines of a capacity of one horsepower or less, and for each horsepower in excess of this up to 10 horsepower, 25 cents is charged; for each horsepower in excess of 10 the charge is 10 cents.

Re-inspections made necessary by inferior workmanship or material are charged for at the rate of 50 cents each, and the rate for permits for temporary work, and also for the inspection of work of this character is one-half the usual charge.

All inspection not covered in the schedule are charged for at the rate of 75 cents an hour, for the inspector's time, and no inspection is made for less than a dollar.

All poles carrying telegraph, telephone, electric light or street railway wires and all covers for manholes for the use of electric conductors must be branded or stamped with the name of the person or corporation owning them; all electric-service entrances must have attached to the conductor, or conductors, in a conspicuous place, a substantial tag designating the owners, and giving such a full description of the conductors as shall meet the approval of the city electrician. Each building into which electric current is introduced must have independent service from the street or alley, entering at right angles with the street curb, except where the service wires are placed

in conduits complying with the rules of the department of electricity; and no wires may pass from one building to another through any party wall or along any building wall or over any roof or under any sidewalk, except where such conduits are used. No electric current may be supplied from any trolley line for any purpose whatever to any building except for lighting the car barns and the power stations from which current is supplied to such trolley lines.

Approved metallic conduits are required for all wires (except such wires as are used for signaling systems) in the wiring of new buildings, the rewirings of old buildings, and in the installation of new wires in old buildings or additions thereto, within the fire limits of the city, and in apartment houses occupied by more than two families, churches, schools, hotels, theaters, opera houses, public buildings and manufacturing establishments outside of the fire limits.

No service wires smaller than No. 10 B. and S. gauge may be used. All joints must be so spliced or joined as to be both mechanically and electrically secure without soldering. The joints must then be soldered to insure preservation and covered with one layer of rubber tape, two layers of friction tape and painted with an approved insulating compound, such as asphaltum or other compounds equally as good.

The License Ordinance.

The ordinance providing for licenses for electricians is given in full below.

"For the better protection of the property and persons of our citizens there is hereby created a board of examiners of electricians, which shall consist of the city electrician, who shall be chairman of said board of examiners, and two other members, one of whom shall be regularly engaged in the electrical-contracting business and the other a journeyman electrician, all of which members shall be practical and competent electricians. They shall all be appointed by the mayor by and with the consent of the city council. Each member of said board shall receive as compensation for his services the sum of sixty dollars a year, payable in equal monthly installments; provided, however, in case the receipts from the license fees hereinafter provided for shall be insufficient to pay the above compensation and the legitimate expenses of said board, their compensation above mentioned shall be diminished pro rata to the amount of said deficiency.

Two members of said board of examiners shall constitute a quorum for the transaction of all business.

"It shall be the duty of the board of examiners to examine all applicants desiring to engage in the work or business of electrical installation or wiring, whether as an electrical contractor or employee (hereinafter designated as journeyman wireman); said board shall examine said applicants as to their practical and scientific knowledge of electricity as applied to the installing of electrical machinery, apparatus and wiring.

"Any person desiring a license to engage in the business of work of electrical installation and wiring as an electrical contractor (hereinafter designated as a master electrician) shall file in the office of the city electrician his application for such license, and shall accompany the same with a receipt from the city treasurer showing payment to the city of a fee of five dollars, and shall afterwards, on notice from the board of examiners, appear before said board and truly answer such questions as may be put to him touching his scientific knowledge and qualifications for conducting the business of a master electrician; and if upon such examination a majority of said board shall be satisfied of his competency to engage in the business of electrical installation and wiring, said board, upon payment by said applicant of an additional fee of twenty dollars to the city treasurer, which payment shall be evidenced by the city treasurer's receipt, shall thereupon issue a license to such applicant authorizing him to engage in the work or business of electrical installation and wiring in the city of Peoria, as a master electrician.

"Any person desiring a license as a journeyman wireman shall file with the city electrician his application for a license as such journeyman, and shall accompany the same with a receipt from the city treasurer showing payment to the city of three dollars, and shall afterwards, on notice from the board of examiners, appear before said board and make answer to such questions as shall be put to him touching his scientific knowledge and qualifications to engage in the work or business of a journeyman wireman, and if upon such examination a majority of said board is satisfied of the competency of such applicant to engage in the business or work of electrical installation and wiring, said board shall thereupon issue a license to such applicant as a journeyman wireman.

Any person who shall engage in the work or business of electrical installation or wiring without having first obtained a license either as a master electrician or a journeyman electrician from the board of examiners of electricians of the city of Peoria, shall be deemed guilty of a misdemeanor and be subject to a fine of not less than five dollars nor more than fifty dollars; provided, however, a licensed journeyman wireman may have with him and working under his constant supervision one helper, who need not be a licensed journeyman wireman.

"All licenses issued as in this article described shall terminate on the first day of May of each year; provided, however, that a master electrician may have his license renewed from year to year by the payment to the city treasurer of an annual fee of five dollars, and a journeyman wireman may have his license renewed from year to year by the payment to the city treasurer of an annual fee of one dollar.

"Any licensed master electrician who shall fail or neglect to carry out and install any electrical apparatus or wiring in accordance with the terms and conditions or any law or ordinance of the city of Peoria, or any rule or regulation of the department of electricity, shall, upon conviction thereof, be fined in a sum not less than five dollars nor more than twenty-five dollars, and the board of examiners of electricians may, upon such conviction, revoke the license of any such master electrician. And when a certificate or license of such master electrician shall be revoked no license shall be renewed to the same person for the first offense for a period of thirty days; for the second offense for ninety days, and for any subsequent offense said master electrician's license shall be permanently revoked, and no license shall be renewed except upon a full compliance with the conditions and provisions prescribed for."

Among the Contractors.

The Douglas Electric Construction Company of New Orleans, La., of which R. R. Douglas is president, has the contract for the complete equipment for the electric plant of the Union Cypress Company of Melbourne, Fla., consisting of one 75-kilowatt, three-phase, 2,300-volt generator direct-connected to an Erie City Iron Works engine. This plant when completed will supply the sawmill of the company and about 70 residences in the vicinity of the sawmill. Future service to the town of Melbourne is contemplated. Another electrical plant for a lumber mill, which is at present being installed, is that of the Covington Lumber Company, of Houltonville, La. The Douglas Company specializes largely in installing complete electrical plants, both isolated and central station, and Mr. Douglas has had a wide experience in this class of work.

The Sieffert Electric Company, electrical contractors of Evansville, Ind., has the contract for the electrical work on the new addition to the Vendome Hotel in that city. The work required is of the most modern nature in every respect.

National Association of Electrical Inspectors.

THOMAS HENRY DAY, president, 59 Deerfield Street, Hartford, Conn.
JAMES BENNETT, vice-president, 524 Coristine Building, Montreal, P. Q.
WILLIAM LINCOLN SMITH, secretary and treasurer, Concord, Mass.
JAMES E. COLE, National Conference Representative, 11 Wareham Street, Boston, Mass.

Executive Committee:

H. S. WYNKOOP, chairman, 13 Park Row, New York, N. Y.

Frank R. Daniel, R. P. Strong, Henry E. Knight, Washington Devereux, James B. McCarthy, W. Lincoln Smith, James Bennett, C. W. Mitchell, George L. Collison, T. H. Fritts, James S. Meade, T. Henry Day, James E. Cole, Thomas D. McColl

Secretary's Message.

Members are probably aware that the convention in New York in March will mark the tenth anniversary of our organization, and it is hoped to remember this with some little extra festivity. The date will be determined by that of the meeting of the Electrical Committee, as usual, and members will shortly receive a circular letter referring to the matter. It is the hope of the Secretary that as many as possible will make their plans to be present at that time and to assist in making things go not only socially, but in the matter of our common electrical interest as well.

The following answers to questions 211, 212 and 213, which appeared in the issue of January 18, were received too late for publication in the issue mentioned. They are given here without repeating the questions, since these can easily be referred to.

Question 211.

Answer 9 (D). Fuse protection should at all times be readily accessible, and the use of fuses in the meter should not be relied upon to afford protection to branch mains or sockets, as they are generally designed to protect only the meter. With reference to the lack of fuses in the neutral lines, we are of the opinion that this is desirable construction, as a neutral fuse offers little or no protection, and in the event of its blowing, the unbalanced part of the circuit is subjected to a higher voltage, which necessarily causes the burning out of lamps and occasionally of sockets and other devices.

Question 212.

Anwer 9 (D). We are of the opinion that fuse and switch protection would not be necessary in the potential taps; but great care should be exercised in the type and construction of automatic switch used. We assume that these potential taps come from the neutral on the outside and that this is permanently and effectually grounded.

Question 213.

Answer 9 (D).—Rule 24 requires that all single-throw knife switches be so placed that gravity will not tend to close them. In the note following it is stated that, where practical, switches should be so wired that the blades will be dead when the switch is open. The first requirement should always take precedence.

The matter appearing in this section consists of questions on the National Electrical Code, its interpretation and meaning, and questions as to whether certain methods of wiring are in accord therewith. These questions are gladly received from anyone interested, even if not a member; they should be sent to the secretary with any needed elucidating sketch. They are answered by each member of the Executive Committee according to his knowledge of what the ruling would be in his jurisdiction.

It should be understood that no pretense is made to give an authoritative interpretation of the Code. This is a voluntary association; it has representation on the Electrical Committee of the National Fire Protection Association, which prepares the Code, but it has no right, and claims no right, to give a final interpretation of anything in the Code. It is only intended to give the interpretation which seems correct to the members of the Executive Committee. No attempt is made to edit or correlate the answers from the different members of the Committee, as it is felt that the occasional difference of opinion is calculated to lead to a further study of the matter in question, further discussion and the final clearing up of obscure points.

The aim is to help toward a better understanding of the Code on the part of all; a more uniform conception of its meaning; increased precision in applying it; and harmonious action of those using it, for the common good.

Terminal Fitting for Wooden Molding.

Question 214. In terminating a line of wooden molding on a side wall, carrying leads to a motor or other piece of appartus set on the floor, what kind of a terminal or anchoring device should be applied to the end of the molding to take the strain off the capping, and under what rule can this be demanded?

Answer 1 (P). An outlet box arranged for the reception of the wooden molding would be desirable at this point, but is not required by the Code. Ordinarily a cleat or a set of knobs would be placed as close as convenient to the end of the molding and would serve to act as a terminal arrangement for the molding, and would take strain from the capping. As soon as the wires leave the molding, the rules for open work apply, and if the supports are omitted, then the wires are not separated or supported as required under Rule 26*h*.

Answer 2 (Q). We think that Rule 26*k* or the third paragraph of "General Suggestions" gives us ample authority for insisting upon a porcelain anchor cleat set across the end of the molding.

Answer 3 (H). A much better construction would be to carry the wires in approved conduit, the lower end of which should go directly to the terminals of the apparatus, the wires themselves coming out of the conduit in an approved outlet bushing, or an equivalent construction.

Answer 4 (B). The point where the wooden molding on the side wall terminates would be the natural location for motor cutouts, switch, etc. Therefore, no terminal or anchoring device would be necessary at the end of the molding.

Answer 5 (D). Rule 26*k* to *m* governs the installation of wooden molding and may be considered as being rather vague in parts. Under the conditions specified we would require the wires to terminate on cleats, knobs or some other approved terminal device.

Answer 6 (E). I know of no rule that meets this condition specifically, unless the first sentence of the third paragraph of "General Suggestions" could be so applied. There are several fittings that could be used so that the installation at this point, might be in full accordance with the third paragraph of "General Suggestions."

Answer 7 (F). While there is no specific rule covering this condition, an inspector would be justified in requesting that the wires be tied in on an approved insulator, or if the wires between the molding and the apparatus were liable to mechanical injury another method of installation should be recommended.

Answer 8 (L). We should not ob-

ject to the use of a porcelain cleat as an anchor for the wires. A better job could be had, though, by the use of a couple of fittings of the condulet type. The proper selection of fitting can easily be made from the catalogs of the manufacturers of such material.

Answer 9 (O). It entirely depends upon the particular apparatus, motor, auxiliary apparatus, etc. We might be satisfied with a Hubbell molding attachment plug, while for anything like a large motor we should require a cleat close to the end of the molding and immediately thereafter the cutout, starting box, etc.

Number of Wires Allowed in Metal Molding.

Question 215. The limitation in Rule 29e is sometimes assumed to limit the number of wires in the molding to two, but in cases where the energy is distributed over several circuits it would seem that more than two wires might be permitted in the molding. In practice how many wires, No. 14 single conductor, No. 14 duplex, No. 12 single and duplex, etc.—may be comfortably accommodated in the molding?

Answer 1 (P). Rule 29*e* could not be construed to limit metal molding to two wires, since the rule contains the words "two or more." The only limitation occurs in Rule 26*e*, which refers to the wattage of the circuits and not to the number of wires. I imagine it would be rather difficult to crowd more than three wires into one piece of molding. If more could be placed in the molding, and the capping properly installed there could be no Code objection, provided no circuit carried over 660 watts.

Answer 2 (B). The intent of the rule relative to metal molding confines the amount of energy in any length of molding to not over 660 watts. In practice we have few, if any, cases where more than two-wire circuit has been run in a single molding; although, if the total amount of energy did not exceed 660 watts, we would permit more than one circuit in a molding. The size of conductor, so far, has been limited to No. 14 B. and S gauge wires.

Answer 3 (F). Rule 29*e* does not limit the number of wires that may be used in metal molding, but does state that the two or more wires of an alternating-current system must be installed in the same molding.

Answer 4 (E). The matter of limitation of number of wires in metal molding is not touched upon in the Code. The wattage limitation is, however. The number of wires of the same circuit depends entirely upon the size of the raceway in the molding. With the ordinary molding now in use, I do not think more than three wires can be conveniently installed, thus admitting of a circuit for a three-way switch.

Answer 5 (D). We believe that good practice permits the installation of as many wires as the metal molding will conveniently accommodate.

Answer 6 (Q). For Lutz metal molding: two single-braid No. 14 B. and S. gauge wires. (Limited by square corners on elbows and fittings). For National metal molding: two single-braid No. 14 B. and S. gauge wires (where there are taps); three single-braid No. 14 B. and S. gauge wires (where receptacles are placed directly on the molding without taps or splices); three single-braid No. 10 B. and S. gauge, or two single-braid No. 8 B. and S. gauge wires for straight work without splices or taps.

Answer 7 (H). I do not read the rule quoted in this question to allow more than two wires in a molding, and should not allow that construction in this territory, the construction of the molding being such, in a case of wooden molding, as to weaken the walls of the molding in case more than two wires were installed in it. This refers, of course, to a two-wire molding; every added wire put in a wooden molding increases very rapidly the hazard of carelessly driven nails, and of moisture accidently getting under the capping. In the case of metal molding the capping cannot be rigidly fastened, and I should much prefer iron conduit for construction where more than one pair of wires was desired in a single run. The distribution of lamps from these moldings can be easily arranged for by going through a junction box and taking therefrom such taps as may be necessary.

Answer 8 (L). Rule 26*m* of the National Electrical Code says, that when alternating-current systems are run in metal molding "the two or more wires of a circuit" must be installed in the same molding. We should be dispose to approve the running of as many as four No. 14 wires in one molding, but we do not recall an installation in which it was necessary to run more than three. Molding of the type in question is designed primarily for use on branch circuits, and for such other work as show-case lighting, and the like, and the Code does not permit circuits having a capacity of more than 660 watts to be run in raceways made of it. Hence we do not see the necessity of a number of wires greater than that mentioned, nor of the use of No. 12 conductors.

Answer 9 (O). Although Rule 29*e* contains the words "two or more wires," it also, to my mind, implies that only one circuit should be admitted to the single molding, and I have never permitted more than one circuit to go in. Wire has been confined to No. 14.

New Patent Bills in Congress.

Believing that a short bill revising the statutes in respect to the fees for patents has a greater prospect of passage than the larger bills before the Patent Committee on the same subject, Representative Bulkley, of Ohio, has introduced such a bill in the House of Representatives. It contains the following provisions:

"Patents for designs may be granted for the term of 7 years, or for 14 years, as the applicant may, in his application, elect."

The following fees are specified:

On filing each original application for a patent, except in design cases, $20.

On issuing each original patent, except in design cases, $20.

In design cases, for seven years, $15; for fourteen years, $30.

On every application for the reissue of a patent, $30.

On filing each disclaimer, $10.

On an appeal for the first time from the primary examiners to the examiners-in-chief, $10.

On every appeal from the examiners-in-chief to the commissioner, $20.

For certified copies of patents and other papers, including certified printed copies, 10 cents per 100 words.

Representative Bulkley has also introduced a bill providing for the appropriation of $4,000,000 for a new Patent Office in Washington. The ground designated is at the beginning of the Potomac Park, a stone's throw from the White House, and property owners of the city of Washington are opposed to taking land belonging to the Government and reserved by it for park purposes to build on, there being so much other land available in and near the city. For this reason, it is expected that many influential Washingtonians will oppose the bill when it comes up for a hearing.

Protest Against Exporting Electrical Energy.

A bill is to be introduced at the next session of the Massachusetts Legislature to prohibit the exportation of electrical energy from the state. The object is to prevent hydroelectric companies from transmitting energy to points outside of the state and selling it there at a price less than inhabitants of the state are now paying for the same service. This action has been aroused by the statement that the New England Power Company is proposing to export to Rhode Island and Connecticut its surplus energy, selling it there at lower rates than now charged to the Massachusetts industries which it serves.

Legal Notes

TAXING PUBLIC-SERVICE COMPANIES.

By Maguire and Mooney.

Certain states grant exemption from taxation to manufacturing companies. Among these, certain ones classify electric light and power companies as manufacturing establishments, while others do not. Even where the plant is exempt, the distributing system may be taxed. Shares of stock are not exempted by this provision.

Generally speaking, electric light and power companies, unless exempted by law, are subject to taxation, but there is so much variance among the statutes and franchises that consideration may be given it. The weight of authority has been to classify electric companies with manufacturing companies in general and give them all the privileges and immunities of manufacturing companies, unless the law or franchise denied them any or certain privileges. But is an electric company a manufacturing company within the purview of these laws? In the case of People *ex rel.* Brush Electric Manufacturing Company vs. Wemple, 127 N. Y., 543, the court held a company generating and distributing electric current to be a manufacturing company. It becomes necessary to invest large capital, to purchase and consume vast amounts of coal, to purchase, maintain and operate a complicated system of machinery consisting of various boilers, dynamos, etc., and then after the generation of the current to distribute it by means of wires, cables and lamps. The electric current produced by this difficult and very expensive method cannot be said to be a gift of nature but a product of capital and labor.

In the case of Commonwealth of Pennsylvania vs. Northern Electric Light and Power Company, 14 L. R. A., 107, the court held that a company which produces electricity and sells it to customers for the generation of light, heat and power, is not a manufacturing company within the meaning of a law exempting stock of such companies from taxation. The court in this case held that the term "manufacturing company" included only those productive industries which should be encouraged in the development of the state's minerals and in the manufacture of the staples of commerce. Whatever electricity may be, it is manifestly not a material substance, and electric companies do not make wares of any kind or reduce raw materials to a form fit for use.

But as will be noted, most of the cases cited herein will be seen to be comparatively old, while all the later decisions hold the electric company to be a manufacturing company within these laws. A very recent decision has held a laundry to be a manufacturing company within this law, not because they manufactured anything, but on account of the fact that they performed a valuable and necessary service in a community. The same argument is equally applicable to electric companies.

However, even if a company should be generating current in a state that held it exempt from taxation, yet if that company had other powers than those necessary to the production and distribution of the electric current it could not avail itself of the right to tax exemption. In the case of People *ex rel.* Western Electric Company vs. Campbell, 145 N. Y., 587, the court, while admitting that the law in New York exempted electric companies from taxation, yet that exemption applied only to companies who devoted their whole attention and energy to manufacturing and distributing the electric current. Accordingly, a company empowered and authorized by its charter to own, lease, etc., all sorts of electrical instruments and to acquire patent rights and to acquire stock in other corporations is not exempt as a manufacturing company, as it is not wholly engaged in carrying on manufacture within the state.

In the case of Frederick Electric Light and Power Company vs. Frederick, 84 Md., 599, the decision of the court was the reverse of cases cited above. But they did bring out a point that is worthy of some consideration. The objects of the law exempting manufacturing companies from taxation are based upon the idea of encouraging the growth and development of manufactures and manufacturing industries. An electric power plant does not require the employment of much labor. On this point the court held that a few men could run the machinery and apparatus of an electric company in the city of Frederick. The court considered the question of whether the owner of a large hotel or house operating its own electric plant, would not be entitled to exemption from taxes as much as an established electric company. Even at that the court decided that if the electric company proposed to manufacture or was manufacturing electrical appliances it would be a manufacturing industry.

States holding electric companies to be classed among manufacturing companies and entitled to the benefit of tax exemption are: New York (case cited above); Alabama (Beggs vs. Edison Electric Illuminating Company, 96 Ala., 295); Colorado (Lamborn vs. Bell, 18 Colo., 346); South Carolina (Mauldin vs. Greenville, 33 S. C., 1); Massachusetts (Opinion, 150 Mass., 572); Maine (Edison United Manufacturing Company vs. Farmington Electric Light and Power Company, 82 Maine, 464); and Kentucky (Kentucky Electric Company vs. Buechel, 146 Ky., 660).

On the other side we find Pennsylvania (Commonwealth vs. Northern Electric light and Power Company, 145 Pa., 105); Maryland (case above cited); Louisiana (State vs. New Orleans Railroad and Light Company, 116 La., 144); and New Hampshire (Williams vs. Park, 172 N. H., 305).

Inasmuch as a number of states have no law at all exempting manufacturing corporations no mention is made of them.

A number of municipalities, in granting franchises to public-service companies, make some provision relative to exemption from taxation and a number of states in exempting manufacturing corporations add specifically all companies in the business of furnishing the public electric current for various purposes.

The very latest decision of this matter (Kentucky Electric Company vs. Buechel, 146 Ky., 660) holds that the generation of electricity for sale is a manufacture, and that the company generating it is entitled to the benefit of a tax exemption. This case went into the question of just what was exempt from taxation. Clearly, the ground on which the plant is situated and the necessary buildings thereon and all the machinery and appliances for generating the current are exempt. But are the poles, wire and outside equipment also exempt? They are assuredly used to transport the electric current and as a means of distributing it to its customers. The wires and poles, of course, are not used in any way in the manufac-

ture of the current so that when the current is introduced into the wires at the factory it is a completed product. But in answer to this it may be contended that without the poles and wires to enable delivery to the consumers the plant would be worthless—that they are absolutely necessary for the success of the company's business.

In an ordinary manufacturing company horses, wagons, boxes, etc., are necessary to pack and transport the manufactured goods, but in no way do they assist in their manufacture. For this reason all outside equipment would not ordinarily come within the exemption, and this has been so decided in the Kentucky Electric Company case above. All property used in distributing, selling and disposing of the current would be subject to taxation.

Where the consolidation of two corporations takes place, one of which enjoyed an immunity from taxation, its property continues to be exempt in the hands of the consolidated company if there is nothing in the law to prevent. This is an established law, although two decisions in the state of Arkansas hold contrary to this practice.

While the law exempts the capital or capital stock of a manufacturing company, or capital employed in manufacturing, no taxes are payable on capital invested in the factory or plant, or the buildings and machinery comprising the plant together with any usable and necessary patents under which the business is carried on. But outside of this everything else is taxable and even though the property is exempt the shares of the stockholders are not exempt.

Public Service Commissions

MASSACHUSETTS.

The Massachusetts Legislature of 1912 directed the Gas and Electric Light Commissioners "to revise, consolidate and arrange the general laws of the Commonwealth pertaining to the manufacture, distribution and sale of gas and electricity, and to corporations engaged therein," and to consider the expediency of additional legislation affecting the relations of such corporations to the public and to one another, and of extending the provisions of existing laws for supervision and regulation. The Commission has rendered its report. On the question of the proposed regulation of transmission companies organized for the purpose of distributing and selling power on a large scale, as distinguished from those corporations which generate and sell to small consumers, which are now under the Board's supervision, a majority of the Board favor the regulation of such companies, while one member believes such regulation is not needed.

For a long time a well-defined legislative policy has been followed in Massachusetts with respect to those engaged in the manufacture and sale of gas and electricity, by which a rigid supervision is exercised over the issue of securities. The Board believes that the codification of existing laws should cover: (1) the formation, internal government and relation of such corporations to their stockholders and creditors; (2) the acquisition, financing and management of municipal plants; (3) the use of the public streets for the distribution of gas and electricity; (4) public supervision and regulation of the business of supplying gas and electricity.

Where a city or town votes to acquire a municipal lighting plant the law provides that the city or town must purchase an existing privately owned plant at the option of the owners. If the parties cannot agree on price, this is determined by a special commission appointed by the court. The Board recommends that cases of this sort be referred to itself rather than to a special commission.

The present statute prohibits consolidation between gas and electric light companies except to a limited extent. The Board is in sympathy with this policy and does not recommend any change by general law. It believes that it is desirable to preserve such competition as may continue to exist by the independent operation of the local distributing companies. The Board recommends that a combined gas and electric company, or the combination of either with a transmission company, cannot be organized without first obtaining the approval of the Board, after public hearing.

On the subject of recommending the granting of eminent domain to high-tension transmission companies, the Board reiterates its position as set forth in a report to the Legislature in 1910, when it said: "The time may not be distant when the proper development of electrical distribution will require the exercise of eminent domain, but the Board is not satisfied that the need is so urgent as to justify it in proposing a bill for that purpose at the present time."

During ten years past, special acts of the Legislature have been passed relative to the disposal of the surplus power at Turner's Falls and Holyoke, on the Connecticut River, by electrical transmission. The corporate powers of the water-power companies were extended, but neither of the companies has undertaken to any great extent to exercise the authority granted to distribute electricity, that which they have sold being delivered at their generating stations. Two companies were organized for the purpose of transmitting electricity at high tension over considerable distances for sale in large quantities for mechanical and manufacturing purposes or to local distributing companies or municipal plants. Both have actively engaged in this business. The Amherst Power Company has a high-tension line from the Turner's Falls Company's power station to the steam power station of the Easthampton Gas Company in that town. The Greenfield Electric Light and Power Company also has lines connecting with the Turner's Falls generating station. All the companies have common control. The Board holds that while there might be advantages if this group of companies were legally consolidated, this is impracticable under present law because two are gas companies and the areas supplied with electricity are not in every case contiguous. The Amherst Company is engaged not in the manufacture of electricity, but in its transmission and is selling to local distributing companies only. The Connecticut River Transmission Company has a high-tension transmission line from the New Hampshire boundary into five important cities of central Massachusetts. Its stock is controlled through a third company by a Maine corporation which also controls the stock of the New Hampshire corporation which owns a dam across the Connecticut River at Vernon, Vt., where is a hydroelectric station with generator capacity for 27,000 horsepower. Through the lines of the Transmission Company, electricity generated at Vernon is delivered to local distributing plants in Gardner, Fitchburg and Marlboro, and to several large factories in Clinton and Worcester. A corporation known as the New England Power Com-

pany is now developing a hydroelectric power on the Deerfield River of an estimated capacity of 40,000 horsepower. Most of the transmission lines of both these companies are over private rights of way. But public ways must be crossed, and in cities or towns streets are followed to a large extent. Up to the present time, except so far as it has been necessary for the transmission companies to occupy the public streets to reach customers, they have not been under the regulation of the Board. Believing that cheap power is of great importance to manufacturing, the Board consented to the entry of the Connecticut River Transmission Company into areas already supplied by local distributing companies. This action has proved stimulating to the local supply companies, and the terms imposed have prevented wasteful competition. The Board holds that this authority should be retained and wholesome competition encouraged.

On the issue whether public regulation should apply not only to local distributing companies but also to power-transmission companies, the Board is divided. In recommending the inclusion of power companies in its authority, the majority of the Board recognizes the advantages which have already come to the public through electrical transmission of water power hitherto regarded as unavailable. They desire to promote this development. All the members agree that the Legislature may well require full publicity from such companies, and should subject them to a restriction of their securities to their actual needs and to such control over rates and service as circumstances warrant.

The Board recognizes the contention that corporations of the sort under discussion be made to serve the needs of all rather than the interests of a few, this claim resting on the recognized public interest in all water powers. The old Mill Acts gave sanction to the development of water powers for distinctively private ends. The hydroelectric companies have taken alvantage of these acts where necessary and there is now a movement to obtain legislation to control the flow of the rivers in further aid of water powers already developed.

Commissioner Schaff dissents in certain particulars, from the position of his colleagues, Chairman Barker and Commissioner Weed, giving for his reason that where competition is wholesome and nondestructive, as in the case of the transmission lines, he has found it the most effective ally of regulation. In the case of these companies, he says, there is no duplication of plants or distribution systems,—the conspicuous evil in competition between public-service corporations.

Any step that would be an obstacle to bringing cheap power to our manufacturers from points outside Massachusetts would be unfortunate. So long as the public policy of the general government continues as it is in the formative stage, it is unwise for the Board to assume further power in regard to these companies, save to require full reports as to all prices and contracts.

NEW YORK.

The records for the Public Service Commission, Second District, show that for the year ending June 30, 1912, the electric railroad corporations of the state paid dividends amounting to $2,992,834 on common stock and $586,744 on preferred stock.

Electrical corporations with gross revenues of more than $25,000, paid dividends amounting to $1,040,336 on common stock and $38,400 on preferred stock.

Electrical corporations with gross revenues between $25,000 and $10,000 paid $26,040 in dividends.

Combined electric railroad and electrical or gas corporations paid dividends amounting to $49,971 on common stock and $73,585 on preferred stock.

Telephone corporations having gross revenues of $25,000 or more paid dividends amounting to $31,735,700 on common stock and $8,944 on preferred stock.

Electrical corporations having gross revenues less than $10,000 paid dividends amounting to $12,347.

Combined electrical and gas corporations having gross revenues of $25,000 or more paid dividends amounting to $2,487,641 on common stock and $211,890 on preferred stock.

One combined electrical and gas corporation having gross revenue between $25,000 and $10,000, the Fort Plain Gas & Electric Light, Heat & Power Company, paid 15 per cent.

The Commission has ordered the New York Telephone Company to desist after February 1 from charging any rate for messages between its Great Neck and Floral Park subscribers' stations and its stations in the Borough of Manhattan in excess of 15 cents per message, and to reduce its message rates between these stations by not less than 5 cents per message.

The Commission has granted the application of the Rochester Railway & Light Company to exercise franchises in the village of Charlotte, Monroe County. As a result of a special election the residents of that village voted to sell its municipal electric plant to the company for the sum of $12,700.

The Commission has authorized the town board of the town of Hadley, Saratoga County, to engage in the sale of electricity for other than municipal purposes. A lighting district has been established in that township in accordance with the requirements of law.

MARYLAND.

Osborne I. Yellott has accepted the position of assistant counsel to the Public Service Commission, taking up the work heretofore conducted by Albert C. Ritchie. Investigation of the affairs of the United Railways of Baltimore is the big proposition that is pending before the Commission and Mr. Yellott, as the people's counsel, will present their side of the controversy.

OHIO.

The Public Service Commission has authorized the Circleville Light & Power Company to issue first-mortgage six-per-cent bonds to the amount of $70,000. The proceeds are to be used to retire outstanding bonds and preferred stock, to construct extensions and to reimburse stockholders for money diverted from dividends and used for construction.

NEW JERSEY.

The Board of Public Utility Commissioners has approved the consolidation of the Salem Electric Company and the Glouchester County Electric Company into a single corporation to be known as the Electric Company of New Jersey. The new concern has been authorized to issue $24,000 of stock and $130,000 of bonds.

TEXAS.

It is considered practically certain that the Legislature now in session will enact a law creating a state public utilities commission. In the house a bill has been introduced by Representative Dwight L. Lewelling, of Dallas, providing for the establishment of this new branch of the state government. Mr. Lewelling's bill is patterned largely after the public utilities law of the state of Wisconsin, but differs from the latter in several important particulars.

Interstate Commerce Commission.

The Commission has had under consideration the matter of the cancellation or destruction of records by electric railways, which includes the operation, accounting, and financial papers, records, books, blanks, tickets, stubs, and documents of electric railways, which may be destroyed after a reasonable time has elapsed. The electric-railway companies were able to prove to the Commission that the accumulation of passenger-fare tickets have become so great as to be burdensome and requires present relief. The result is that the Commission has ordered that, pending the entry of a general order in the matter of the destruction of such records, they may be permitted to destroy used or canceled passenger-fare tickets, etc., under provisions already issued for steam roads. This order became effective January 31.

Revision of Ratings and Methods of Testing Electrical Apparatus.

A joint meeting of the Chicago Section of the American Institute of Electrical Engineers and of the Electrical Section of the Western Society of Engineers was held in the latter society's rooms, Monadnock Block, Chicago, on the evening of January 27. The first order of business was the election of officers of the Electrical Section of the Western Society for 1913. This resulted in the choice of R. F. Schuchardt as chairman, F. G. Postel as vice-chairman, and P. B. Woodworth as member of the Executive Committee.

The main feature of the evening was an informal talk by B. G. Lamme, chief engineer of the Westinghouse Electric & Manufacturing Company, on the subject "The Desirability of Revising the Ratings and Methods of Testing Electrical Apparatus," which is the subject that is to be considered in detail at the midwinter convention of the American Institute of Electrical Engineers to be held this month. Mr. Lamme reviewed the history of the Institute Standardization Rules and stated that they had been nearly always behind the times because by the time they had been drawn up to conform with the current practice, the latter had already been further changed. The large manufacturing companies, being leaders in establishing practice, have been the worst offenders in not living up to the more obsolete rules. In the proposed revision, in the committee work of which Mr. Lamme has been very prominent, it will be aimed to anticipate changes that it can be foreseen are bound to come in practice, so that the new rules will be in the lead of practice instead of behind it as heretofore. No attempt will be made at standardization of designs, as this would evidently hamper development, but standardization will be attempted of ratings and tests, so as to permit, for instance, of more definite guaranties under contract requirements for electrical machinery.

In this connection probably of greatest importance will be the recommendations regarding temperature. Mr. Lamme made it very clear that the ultimate or absolute temperature of an insulation is the feature that is liable to affect its deterioration and that this is very much more important than a mere statement of the temperature rise of the apparatus. Therefore, the ultimate temperature is to be made the basis of limiting outputs in the new ratings. The effect of heat on insulating materials should be looked at from the mechanical and electrical standpoints. Excessive temperature usually affects chiefly the mechanical properties by causing disintegration of the binder elements in the insulation. If the separation of the conductors is not decreased, then in the case of a moderate-voltage machine the electrical properties of the insulation are not necessarily decreased materially by excessive temperature. Mr. Lamme cited an instance in which the insulation had been completely carbonized but the machine remained electrically intact and in fact was kept in service for several years, even though the insulation was extremely weak mechanically. In the case of high-tension apparatus, high electric strength of insulation is necessary, otherwise it may break down through puncture.

The methods of testing temperatures have been very defective because they have not measured the hottest point of the machine; consequently, although the average temperature may have been measured with a fair degree of accuracy, this did not indicate that there were no spots in the windings that were very much above a safe temperature. It has been found that 100 degrees centigrade can be regarded as the maximum safe temperature that can be imposed continuously on fibrous insulations with a reasonable life of the latter. Therefore, this temperature is taken as the ultimate limit for continuous service. However, if the insulation is subjected to higher temperatures intermittently, it can doubtless stand over 100 degrees centigrade maximum with about the same ultimate life, say, ten years or more. As the maximum temperature imposed increases more and more over 100 degrees, the life of the material is very rapidly reduced. The ordinary thermometer methods of measuring temperatures of windings are likely to be very erroneous. The hottest part of the windings may be from 5 to 10 degrees higher than the outside of the insulation in ordinary low-voltage machines and from 20 to 30 or even 50 degrees higher in the case of high-tension machines with very thick insulation. It is much more important to know the temperature of the cooling medium than it is to know that of the average temperature of the room. Although there will be some difficulty in determining the maximum internal temperature, this probably will not be as great as temperature determinations with the old method of finding temperature rise. In the case of both fibrous and mica insulations the temperature gradients have been determined with a fair degree of accuracy so that corrections can be made to secure uniformity of temperature throughout the windings of machines. In the case of alternators, for instance, if the end turns are reasonably well ventilated, the internal temperature will doubtless be safe. In the case of machines with very long cores or of machines designed for very-high-tension work, mica is becoming more generally used. Its temperature and life characteristics are not perfectly known because it has not yet been in use for a sufficiently long time, but a maximum temperature of 125 degrees centigrade has been recommended as the ultimate temperature to which it may be subjected continuously with reasonably long life.

The sentiment in connection with rating of machinery and apparatus is strongly in favor of adopting continuous ratings instead of specifying a nominal full load and certain overload guaranties, because, if the machine can carry a certain load continuously with safety, it can certainly carry anything below that maximum rating. The design must always be for maintained-peak service, and therefore it is absurd to underrate the machines and to specify overloads. Consequently what the machine will carry continuously without exceeding an ultimate safe temperature is, or should be, the rating. Mr. Lamme illustrated this by giving many instances of absurd conditions arising under the present method of rating and the inconsistency of requirements that are frequently imposed on the designer.

Respecting the methods of measurements of losses and of efficiency, Mr. Lamme said that the method of measuring the separate losses is undoubtedly much more accurate than the input-output method. An error of one or two per cent in the measurement of the individual losses results in a relatively trifling error in the calculated efficiency, whereas a similar error in determining the input of a generator, for instance, makes an extremely important difference in the resulting efficiency. In the method of measuring the separate losses, the only element of uncertainty is determining what are known as the stray losses, but these can be very closely estimated in the case of practically every type of machine to within perhaps 0.25 per cent. The other losses can be measured with a high degree of accuracy. The input-output method of measurement is not only less accurate, but is also much more expensive than the separate-loss method. Therefore, the practice doubtless will be to use the latter more and more. This is a very important matter, because in measurements for determining whether certain guaranties have been attained it is highly desirable that more accurate methods be used than are now in vogue.

The discussion of the subject was opened by W. B. Jackson, who called attention to the fact that the aim in the new rules will be to use the iron and copper of electrical machinery to much greater advantage than is now the case in many instances; the tendency will be to get the best machine for conditions specified at the lowest possible price.

W. C. Bauer, of Northwestern University, emphasized the fact that disintegration of insulating materials is due to chemical changes therein. It is important to limit the temperatures since chemical affinity varies about as the square of the temperature.

B. H. Glover, of the Underwriters Laboratories, said he was glad to note the recognition of mica as an insulating material. He asked respecting the life of mica and other insulations under the ratings imposed. Mr. Lamme replied that it is impossible to give a definite statement of the life of mica insulation at the proposed new temperature limits, but it is believed that these will give a reasonably long commercial life, in excess of ten years. Respecting other insulating materials no regulations will now be made, because insufficient data are available; but as more is known about new materials, it is expected that new rules will be adopted for them.

Others who discussed the subject were Hugh Pattison, P. B. Woodworth, Joseph Jacobson, and Mr. Van Hatton.

The next joint meeting of the two sections will be held on the evening of February 24, when L. B. Andrus, of South Bend, Ind., will read a paper entitled "Synchronous Condensers."

Connecticut River Power Project Before Congress.

In accordance with President Taft's recent message to Congress, advocating the payment by power companies to the Government for the use of water in navigable streams, a bill carrying out that principle is expected to be shortly passed by Congress.

The bill in question grants the right to the Connecticut River Power Company to construct a dam across the Connecticut River above the village of Windsor Locks, and it has been favorably reported. The Secretary of War issued a statement containing the following in regard to the bill and the principle of payment involved, at Washing on January 24:

"The bill contains a proviso authorizing the Secretary of War to impose a reasonable annual charge, to be paid by the corporation, for the privilege granted, these proceeds to be used for the development of navigation on the Connecticut River and the waters connected therewith.

"For a number of years applications have been made to the federal Government to improve this portion of the Connecticut River so as to permit navigation to pass around the rapids which obstruct the river at that place, but the board of engineers to whom the project has been referred has uniformly reported that the expense of such an undertaking would be so great as to make it inadvisable for the federal Government itself to assume the burden and expense. Under the present bill this burden is assumed by the private company, which is to develop the water power, and in addition the company stands ready to pay additional compensation to the federal Government. In anticipation of favorable action on this bill, I have been in negotiation with the company, and a basis of agreement has been reached with the company under which its books, showing all of the actual expenses of the enterprises, are to be open to the Government, and the profits from the sale of water power are to be carefully tabulated and accounted for under standards subject to the approval of the board of engineers.

"It is estimated that the total enterprise will cost in the neighborhood of $5,500,000, of which about $470,000 will be required to be spent in constructing a lock and channel exclusively in the interest of navigation. The Government will thus at the outset get the benefit of an investment of nearly half a million dollars spent solely for navigation without reference to water power—or, in other words, an equivalent of an interest charge of nearly $30,000 per annum.

"The company is to receive the net profits derived from its investment to an extent of eight per cent upon the actual cash investment. In view of all the conditions of the case, I regard this as a fair and yet conservative amount of return for such a water-power development.

"Thereafter, all further net profits are to be divided between the company and the Government. Between 8 and 9 per cent, they are to share equally, and beyond 9 per cent the government is to share in an increasing ratio. I deem this a far more advantageous arrangement than to deny the company any share in the profits beyond 8 per cent, in that beyond that point it leaves an inducement to the company for good management and for earning money for the public by partly sharing in it itself.

"Furthermore, in order to provide for a possible increase in the profits of such a business as years pass and water powers may increase in value, I have insisted that after 30 years under the present arrangement there is to be a readjustment of compensation by agreement between the Government and the grantee, and that thereafter such readjustment is to take place at the end of every 10 years until the termination of the permit, the life of which is 50 years altogether.

"This case offers a good illustration of what can be done under the policy of insisting upon compensation for the grant of these privileges. It has hitherto been the policy of the nation to allow these water powers to pass into private hands without getting anything for them whatever. Only a year ago this company sought the privileges granted by this bill and expected to get all the profits from the water-power development for its own use. And it would have done so had the same policy been carried out which has obtained in the multitude of other similar bills passed in former years.

"Under the policy now insisted upon by President Taft, it turns out that they are not only willing to make this large initial investment for the benefit of the Government, but they are prepared to share their profits beyond 8 per cent with the Government, under conditions which provide for accuracy and publicity in determining what those profits shall be. I think that every public interest is satisfied by the bill, and the fact that it is also satisfactory to those persons who are about to embark their money into the enterprise, indicates that a legitimate development of water power is reconcilable with a proper protection of the interests of the public."

Stating the case for the advocates of the principle that the federal Government has the right to make an annual rental charge on power dams, Senator Burton says:

"It appears to be a settled question that the federal Government may impose a charge for the use of the surplus water, not needed for purposes of navigation, which may be made available incidentally to the construction of a dam by the federal Government for purposes of navigation.

"It would seem equally evident that the federal Government also has the right to utilize a private agency for the construction of dams in aid of navigation, granting the use of the incidental water power thereby created to the constructing company in compensation and requiring such other return as the circumstances may warrant.

"The bill presented marks the most distinct step yet taken toward this method for the improvement of navigation in combination with hydroelectric development under the control and supervision of the federal Government, but without federal expenditure.

"It is believed that the authority of the Secretary of War to require a return to the Government in case the corporation earns more than a reasonable return on its *bona fide* investment will be in effect a regulation of the charges of the company as well as a source of revenue to the Government, because it will be one of the most important factors to be taken into consideration by the public utility commissions of Connecticut and Massachusetts in fixing the rates of service which the company may charge."

Notwithstanding the fact that the bill has been favorably reported, some members of the Senate Commerce Committee have brought in a minority report and declare they will fight the bill. They say:

"We recommend the passage of the bill

with the amendments suggested (elimination of federal rental clause) for the following reasons:

"(1) If the federal Government has no right, and it has none, to control the use of the water power in the Connecticut River, then Congress cannot legally legislate on the subject of such control.

"(2) Because, if the bill is not amended as suggested, a valuable natural resource of the state of Connecticut is confiscated.

"(3) Because the state of Connecticut owns the water and the bed of the Connecticut River and the federal Government having no proprietary interest in the water power of said river has no moral or legal ground to demand compensation in any form, for the use of the water power in said river.

"(4) Because the federal Government has no right to withhold the permit for the building of the dam proposed by the Connecticut River Company in the said river, for the building of this proposed dam and lock will not interfere with navigation, but improve it.

"A majority of the committee in their report say: 'It appears to be a settled question that the federal Government may impose a charge for the use of the surplus water not needed for navigation.' We, the minority, deny that this question has been settled and we challenge the majority to point to a single law on the statute books or to a report of a single committee in Congress or to a single decision of the Supreme Court which tends to establish their contention. On the contrary, the principle has been denied from the beginning of the Government and that denial has been upheld by the Supreme Court deciding the question more than 60 years ago and repeated at least 30 times since."

The first electric plant in Arabia has been installed in the palace of the Sultan of Oman, at Maskat.

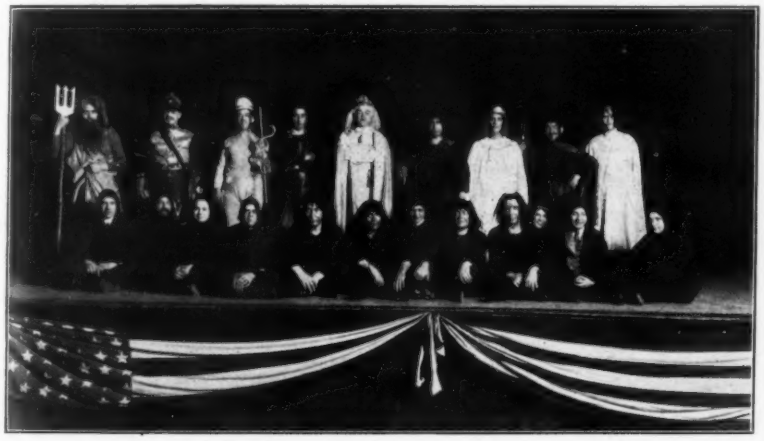
Peoria Joviation.

A rejuvenation of Jovians was held at the Hotel Jefferson at Peoria, Ill., on Thursday evening, January 23.

Many prominent members arrived the day before to take part in the ceremonies and the parade at the Coliseum was led by the degree team, consisting of the following: Jupiter, Frank A. Driscoll, Pass & Seymour, Incorporated; Vulcan, J. W. Foster, Holophane Works; Neptune, W. E. Finlay, Chicago Fuse Manufacturing Company; Pluto, F. W. Endsley, Mills Electric Company; Mercury, W. E. Wolgamott, city electrician, Peoria; Avrenim, A. A. Guardia, Pelouze Manufacturing Company; Mars, F. D. Sweet, of C. S. Knowles; Imps, F. L. Lewis, Holophane Works; P. H. Nicholas, Monarch Electric & Wire Works; C. J. Hines, Columbia Incandescent Lamp Works; Charles Dubski, Crouse-Hinds Company.

A class of 16 was initiated on Thursday evening. A. R. Dean was toastmaster at the banquet, which was held at the hotel immediately following the ceremonies. Interesting talks were delivered by F. A. Driscoll, C. E. Stapp, F. D. Sweet, Charles Dubski, H. M. Butler, A. A. Guardia, J. M. Foster and W. E. Wolgamott.

The occasion was a very enjoyable one and credit is due W. E. Wolgamott, Statesman of Illinois, who was in charge, for the excellent program and the admirable manner in which the entire affair was conducted.



Degree Team in Charge of Jovian Rejuvenation at Peoria, Ill.

Baltimore Jovians Meet.

The members of the Jovian Order of Baltimore, Md., held a most interesting luncheon on Thursday, January 23, at the Hotel Emerson. Meetings are held every week by the organization and the interest in them is increasing. At this luncheon there were about 65 members present. The main feature of the meeting was an address by Mayor Preston.

New Officers of Colorado Electric Club.

At a meeting of the directors of the Colorado Electric Club, held in the office of William J. Barker, general superintendent of the Denver Gas & Electric Light Company, January 14, Benedict Shubart, a well known Denver electrical man, who is head of a supply house which bears his name, was elected president for the ensuing year. Along with Shubart, Joseph F. Reardon, former electrician for the City and County of Denver and General Irving Hale, who is identified with the local branch of the General Electric Company, were elected as first and second vice-presidents, respectively. C. F. Oehlmann, who has held the office of secretary-treasurer ever since the club was formed, was re-elected.

The directors of the club for the year, in addition to these officers, are: W. J. Barker; H. L. Woolfenden, General Electric Company; W. H. McAloney, Denver City Tramway Company; L. M. Cargo, Westinghouse Electric & Manufacturing Company; John F. Greenwaldt, Bell Telephone System; J. Frank Dostal, Colorado Springs Light, Heat & Power Company; W. F. Cozad, Mountain States Telephone Company.

W. H. H. Cranmer, highway commissioner of the City and County of Denver, was the speaker at the regular weekly luncheon on January 16. "Efficiency in Municipal Affairs," was the subject on which he talked. Mayor Henry J. Arnold and the members of the Board of Public Works were present at the luncheon as guests.

Secretary Oehlmann announced that the average attendance at the luncheons during the year just closed was 112, but that it was expected this would be increased to an average of 150 per luncheon during 1913.

New York Companies Section, National Electric Light Association.

The New York Companies Section of the National Electric Light Association held a very pleasant meeting on the evening of Monday, January 20, at the Edison Auditorium, 44 West Twenty-seventh Street, New York City. Frank M. Tait, president of the National Electric Light Association, spoke on association matters and outlined the many ways in which the National organization was doing effective work in promoting the interests of the central stations of the country. M. W. Franklin, of the General Electric Company, delivered an interesting address on "Ozone and Its Applications," and B. R. Baumgardt, ex-president of the Southern California Academy of Science, delivered a lecture, entitled "The Latest from the Heavens."

A NEW DIFFERENTIAL WATT-PER-CANDLE METER.

By Edward P. Hyde.[1]

Several methods have been devised by which the watts per candle of an incandescent electric lamp may be determined by a single reading. In 1906, in collaboration with H. B. Brooks, the author published an account of such a method[2] which consisted essentially in reducing the reading of a wattmeter in proportion to the candlepower of the test lamp by the introduction of a variable resistance in the pressure circuit of the wattmeter. Various modifications of this method have been proposed from time to time by Ives,[3] Amrine and others.

Recently Ives has[4] devised a quite different method of measuring watts per candle directly, this method making possible the direct determination of the voltage required for a given watts per candle without the use of a so-called volt-scale. Various other schemes[5] have been proposed at different times, but none of them is entirely free from objectionable limitations. In particular, none of them can be used with any satisfaction on a circuit of fluctuating voltage, such as is frequently the only kind available in lamp factories, and on which quite accurate photometric measurements can be made, using the same-circuit substitution method of measurement.

It was this limitation in the use of the older watt-per-candle meters that suggested the "New Differential Watt-per-Candle Meter" which forms the subject of this paper. Fig. 1 shows the principle of the new method. Before discussing this method, however, it may be well to describe in a few words the same-circuit method of photometry which is frequently used in factories where constant voltage is not available. This method is clearly shown in Fig. 1, if the two rheostats *MK* and *ED* are eliminated, and the potential circuit *S G T* is disregarded.

From one side, *A*, of the line *AB* the current flows through the common resistance *r* to the branch point *O* where it is divided. From this point one circuit goes through the test lamp L_1 and back to the other side, *B*, of the line. The voltage V_1 on the lamp equals, therefore, the line voltage *V* minus the drop V_r through *r*. The other circuit goes through the series resistance r_2 and then back to *B*, the voltage V_2 on the working standard L_2 equaling therefore V_1 minus the drop V_{r_2} through the rheostat r_2.

If now 110-volt lamps are to be tested, the rheostat *r* is adjusted until the voltage V_1 is approximately 110 volts. A 110-volt standard lamp of known candlepower is then placed in the socket at L_1 and the working standard L_2 is placed[6] at a point on the bar corresponding to the known candlepower of the standard at L_1. The auxiliary rheostat r_2 is then adjusted until there is a photometric balance. The photometer is then in adjustment, and test lamps substituted for the standard at L_1 can be measured with considerable accuracy even though the line voltage *V* may fluctuate, for such fluctuations affect both working standard and test lamp very nearly alike, provided, of course, that the two lamps have filaments of the same material.

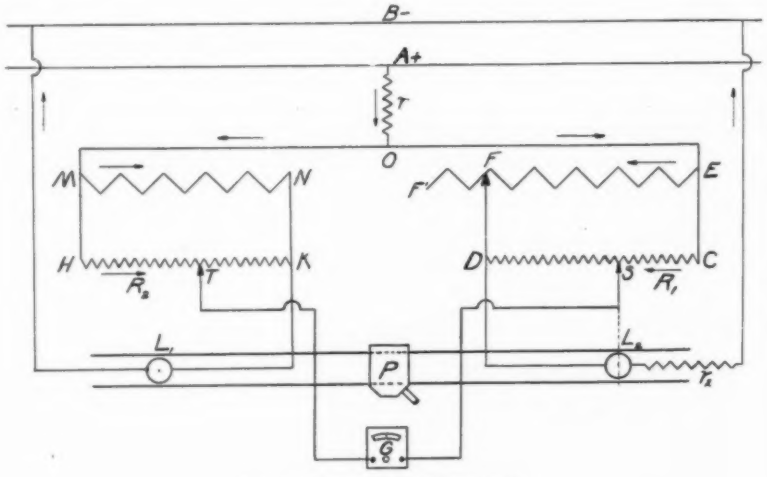


Fig. 1.—Diagram of Connections.

The application of the new differential method of measuring watts per candle to this same-circuit method of photometry involves the introduction of the two rheostats *MK* and *ED*, as shown in Fig. 1. Each of these rheostats consists of a low-resistance coil (*MN* or *EF*) shunted by a coil of somewhat higher resistance (*HK* or *CD*). The reason for this particular form of rheostat will be evident subsequently. *T* and *S* are potential contacts such that when the fall in potential through *CS* equals that through *HT*, the galvanometer or millivoltmeter *G* will show no deflection.

The principle involved in this new differential method is quite simple. Let us assume for the moment that the resistance r_2 in series with the working standard is zero. (Subsequently the influence of r_2 will be considered.) Then the voltage V_2 on the working standard L_2 and that, V_1, on the test lamp L_1 will be practically the same, since the resistance, *MK* approximately equals the resistance *ED* and both *MK* and *ED* are small (about 1 or 2 ohms) in comparison with the resistances of the lamps (about 300 ohms in the case of a 40-watt, 110-volt lamp, or 200 ohms in the case of a 60-watt lamp). Now the watts per candle of L_1 and L_2 will be respectively $E_1 = V_1 I_1/\gamma_1$ and $E_2 = V_2 I_2/\gamma_2$ where I_1 I_2 and γ_1 and γ_2 are the respective currents and candlepowers of the two lamps. Since V_1 equals V_2 as stated above, the ratio of the watts per candle for the lamps will be

$$E_1/E_2 = I_1\gamma_2/I_2\gamma_1. \quad (1)$$

Suppose now that we make the current I_1 of lamp L_1 to flow through a resistance R_2 proportional to the candlepower γ_2 of lamp L_2, and the current I_2 of lamp L_2 to flow through a resistance R_1 proportional to the candlepower γ_1 of lamp L_1. Then equation (1) becomes

$$E_1/E_2 = I_1R_2/I_2R_1 = v_1/v_2 \quad (2)$$

and so the ratio of the watts per candle, E_1, of the test lamp to that, E_2 of the working standard, is equal to the ratio of two potential differences v_1 and v_2. If these two potential differences are equal, then the two lamps are at the same watts per candle. If they are different, then one resistance R_2 can be varied (multiplied by a factor *x*) until the two potential differences (v_1 and v_2) are equal. The magnitude of *x* is then a measure of the ratio of the watts per candle of the two lamps. The equality of potential difference is indicated by the galvanometer or millivoltmeter.

It is readily seen how this theory is practically applied by returning to a

1 Physical Laboratory, National Electric Lamp Association.

2 *Bulletin Bureau of Standards*, 2, page 145; 1906. See also *Electrical World*, 46, page 942; 1905.

3 *Bulletin Bureau of Standards*, 5, page 543; 1909.

4 *Electrical World*, 59, page 1268; 1912.

5 Birdsall, *Electrical World*, 60, page 157; 1912.

6 Formerly it was the custom to mount both the working standard and test lamp in fixed positions, making the adjustment by moving the photometer head. It is now becoming common to keep the photometer head in a fixed position, and to make the adjustment by moving the working standard. The method of measuring watts per candle described in the present paper is presented in connection with the latter arrangement, but is equally applicable to the older scheme.

consideration of Fig. 1, which shows the arrangement diagrammatically. Let us ignore for the moment the low resistance shunts *MN* and *EF*. The resistance *CD* is so adjusted that the resistance R_1 from *C* to the potential point *S*, attached to the movable working standard L_2, is always proportional to the candlepower of L_1. This is accomplished by having a contact-brush *S*, attached to the adjustable lamp L_2 and having this brush move over a horizontal block on which are mounted a series of metal strips connected by resistance coils suitably calibrated.

If, now, the contact point *T* is so placed that the resistance *HT* or R_2 is proportional to the candlepower of the working standard, L_2, the conditions of equation (2) are fulfilled. For the current of lamp L_1 is flowing through a resistance proportional to the candlepower of L_2 and the current of L_2 is flowing through a resistance proportional to the candlepower of L_1 and the ratio of the two potential differences v_1 and v_2 is equal to the ratio of the two watts-per-candle values E_1 and E_2. If these latter are equal, then the two potential differences, v_1 and v_2, will be equal, and the galvanometer *G* will show zero deflection, since the two points *S* and *T* will be at the same potential. If the two values of watts per candle are not equal then v_1 and v_2 will not be equal and the galvanometer will show a deflection. By moving the contact point *T*, however, i. e., by varying the resistance R_2, a zero deflection of the galvanometer can again be obtained. The amount by which R_2 is varied, i. e., the factor x with which it is necessary to multiply the resistance R_2 in order to obtain a zero deflection, is an indication of the difference between the watts per candle of the working standard L_2 and that of the test lamp L_1. The resistance coil *HK* is so constructed that the potential point *T* is varied by the use of either a slide wire or a dial rheostat, the slide wire or the dial being calibrated directly in either watts per candle, or volts corresponding to a given standard watts per candle.

The two rheostats *CD* and *HK* have the same total resistance, and it is to be noted that all of one rheostat is constantly in series with one lamp, and all of the other rheostat is constantly in series with the other lamp. The variable contacts *S* and *T* affect only the galvanometer circuit.

Now it is desirable from some aspects that the rheostats *CD* and *HK* have each a reasonably large resistance, one reason being the greater facility in constructing and mounting the individual coils between the segments of the rheostat *CD*. In the plan for constructing the first instrument of this type 10 ohms was tentatively decided upon as suitable for each rheostat. But the effect of so large a resistance as this would be to produce quite appreciable errors in testing successively lamps having somewhat different currents. Hence these high-resistance rheostats *CD* and *HK* are shunted by coils *EF* and *MN* of lower resistance, approximately 1 or 2 ohms. *EF* and *MN* are quite approximately equal in resistance, though *EF* is slightly adjustable for purposes of empirical calibration of the instrument.

There are four sources of error to be considered:

(1) Fluctuations in the line voltage.

(2) Variations in the effective voltage owing to differences in the currents of the test lamps L_1 and corresponding differences in potential fall between *A* and *O* through the common resistance *r*. This error arises fundamentally from the series resistance r_3, which bears a different ratio to the resistance of lamp L_2 when the voltage varies.

(3) The effect of the one-ohm resistance (*HK* shunted by *MN*) in series with the lamp L_1 when the test lamps L_1 have different currents.

(4) The possible uncertainty in applying the coefficient of change in volts with change in watts per candle.

The first and second effects are similar in nature and occur in the use of the same-circuit method irrespective of the introduction of the watt-per-candle meter. These errors are negligibly small in all ordinary practical cases. Moreover it can probably be shown to be universally true that the error in watts per candle due to these effects is always in the same direction and of a relatively smaller numerical magnitude than the corresponding errors in candlepower in the use of the same-circuit method before the introduction of the watt-per-candle meter.

In a similar way a computation of the effect of the third source of error which does not occur in the ordinary same-circuit method of photometry, but which is peculiar to the new arrangement for measuring watts per candle, show this error to be negligibly small in all practical cases. The possible error depends on the ratio of the resistance *MK* to that of the lamp L_1, and on the variations of current encountered in testing lamps of a given lot. There is no reason why the resistance *MK* cannot always be kept sufficiently small to render this source of error negligible.

Regarding the fourth possible source of error, there would seem to be no reason why with tungsten lamps the uncertainty in our knowledge of the relationship between watts per candle and voltage should produce any appreciable error. If we assumed test lamps varying in watts per candle to the extent of ± 20 per cent and if we assumed the coefficient expressing the relation between change in volts and change in watts per candle to be as large as 5 per cent, the volt scale could still be relied upon to within an accuracy of 1 per cent. Published data would indicate that this coefficient can be known to within 2 or 3 per cent and it is probable that variations of ± 20 per cent in efficiency constitute a very liberal allowance.

It would seem, therefore, that the instrument is thoroughly flexible and free from objectionable error.

The complete method of operation in determining watts per candle by the new method in use with the same-circuit photometer is as follows. Placing a checking standard L_1 and choosing a suitable working standard or comparison lamp for L_2, the common resistance *r* is adjusted so that the voltage of L_1 is the desired voltage at which the lamps are to be measured. The variable resistance r_2 is then adjusted until there is a photometric balance when lamp L_2 is set at a position corresponding to the known candlepower of the checking standard L_1. The potential point *T* is so adjusted by the motion of the slider or the dial, as the case may be, until the reading of the latter corresponds to the known watts per candle of the checking standard L_1; or, if the dial scale is calibrated in volts, the point *T* is set so that the dial pointer indicates the known voltage at which the checking standard L_1 would have the standard watts per candle. The low-resistance shunt *EF* is then adjusted until the galvanometer shows no deflection.

If, now, test lamps are substituted for the checking standard L_1, the reading of the dial of *T* when there is a zero deflection of the galvanometer will give accurately the watts per candle of the test lamp or the voltage for the standard watts per candle, according as the dial scale is calibrated in watts per candle or volts.

There is no reason why the millivoltmeter or galvanometer might not be calibrated directly in volts or watts per candle so that there should be no necessity for the second operation of setting the slide-wire or dial *HT* for a zero deflection. If the scale of the millivoltmeter or galvanometer is properly calibrated for the various types of lamps to be tested the required watts per candle or the required voltage for a given watts per candle could be read directly. This latter method might seem at first glance to be more rapid and therefore preferable, but the author inclines to the opinion that the gain in time, if there is any appreciable gain, is more than offset by other advantages of the zero method of measurement, and so this latter is strongly urged, notwithstanding the necessity of an extra operation. The advantages of this are:

(1) Contact resistance at *T* and *S* is eliminated.

(2) There is no need to calibrate the galvanometer or millivoltmeter *G* and

hence if this instrument meets with moderate accident it can still be used without error, provided it indicates at all.

(3) The resistance *HT* can be made in any form desired, as many scales as desired can be used and the scale can be as open or as closed as is wanted. The flexibility of the instrument is therefore very much greater.

If, however, it is ever desired to use the galvanometer or millivoltmeter as an indicating instrument, keeping the resistances constant, the adaptability to the different types of lamps will be accomplished by one of two methods:

(1) Placing a resistance in series with the galvanometer so as to reduce its deflections when high-current lamps are used.

(2) Shunting the resistances *HK-MN* and *DC-FE*.

Regarding the application of the above watt-per-candle meter to separate-circuit photometry, it would seem that the instrument is perfectly adapted to this, provided the method of procedure is to bring all the test lamps to the same voltage and to determine the voltage for a given watts per candle. If for any reason it is desired to keep the voltage of the working standard, or comparison lamp, constant, but to vary the voltage of the test lamp, the instrument is not applicable. One must then turn to one of the earlier forms of watt-per-candle meters.

Some caution must be exercised in the choice of a suitable galvanometer. An ordinary portable millivoltmeter of the proper resistance is moderately satisfactory, though perhaps a specially designed galvanometer might be more satisfactory. The galvanometer should however be of the portable type, and of such rugged construction both mechanically and electrically that it could withstand ordinary factory usage and that it could be subjected without serious damage to the entire potential drop through *CS* or *HT* that would occur in case of a broken circuit. There seems to be no reason why such a galvanometer should not be readily obtainable.

Maintaining Service During Construction.

At the regular monthly meeting of the Pittsburgh Section, American Institute of Electrical Engineers, January 14, the speaker of the evening was G. N. Lemmon, on "Maintenance of Service During Construction Work."

Mr. Lemmon brought out the fact that the objective point of all electrical engineering is the operating man, and through him the consumer. Probably the most difficult work of the service man is the reconstruction of a station or transmission line without interrupting service. This is only possible by selecting and training a gang of men who can be depended on to do careful work on hot lines and in crowded quarters without running unnecessary risks, or making mistakes which are liable to cause accidents. He praised highly the loyalty and enthusiasm of the average gang of men who have been working together for a while, citing instances of continuous work for 24 or even 36 hours during emergencies.

The main body of the talk consisted of descriptions of a number of reconstruction jobs, with a discussion of many ingenious methods devised to overcome difficulties, and makeshift arrangements necessary to prevent interruptions, the details of the work being illustrated by lantern slides. One of the interesting construction features discussed was the use of rubber hose, filled with water under pressure, as forms for ducts in a concrete floor. The cement was poured around the hose and allowed to harden. When the water pressure was removed, the hose was pulled out, the resulting duct being smooth and of any desired curvature.

Of especial value was the description of the method of changing a 16-mile transmission line, composed of two three-phase feeders in parallel, one on each side of the pole, from 11,000 to 22,000 volts, and simultaneously reconstructing a substation for the same voltage. All cross-arms and insulators were changed, one feeder being dead and the other alive during the reconstruction work. A rack was mounted on the pole, and three wooden rods were provided with insulators having special clips on the top to hold the line. The live wires were lifted out of the danger zone by these rods, which were held by the rack until the cross-arms and insulators were changed. The insulators on the live side of the pole were provided with temporary spring clips, into which the line was lowered. During dry weather it was found that ordinary manilla rope formed a good insulator for the 11,000 volts, and the live lines were simply pulled away from the pole by rope, considerably facilitating the process. Under favorable conditions three poles, each having two cross-arms and six insulators, were changed in an hour by three linemen and one groundman.

In reconstructing the substation, constant watchfulness was necessary to prevent the masons and carpenters from coming into contact with the live wires, as in spite of repeated warnings, these men did not seem to have any conception of the danger involved.

In the discussion, L. O. Beser, who had worked with Mr. Lemmon on the line construction described, added that reconstructing the 16-mile line required from July 1 to the latter part of October, working on dry days only. This involved possibly 100 actual working days, most of the work being done by one gang of men. The final tying of the lines to the insulators was done on dead lines only, the feeders being alive on alternate days. The dead line was always short-circuited by a chain while work was being done on it. The cost of the entire change over, including labor, supervision and materials, was $475 per mile. The average cost of labor amounted to $1.50 per single-arm pole. The poles were chestnut and ten years old, but they were little rotted, though many of the old cross-arms were badly rotted.

G. C. Hecker discussed the development of the Brunots Island Plant of the Pittsburgh Railways Company from 2,200 volts, two-phase, having two 1,500-killowatt units, to 11,000 volts, three-phase, with four turbines added to the original equipment.

P. M. Lincoln emphasized the fact that the operating man must sacrifice efficiency, beauty and everything else in order to "keep juice on the wires."

C. S. Jenks further emphasized the importance of continuity of service, stating that the operating man who could ensure 100-per-cent time efficiency would outrank Steinmetz and Edison. The time efficiency of the West Penn system for the past three years has been 99.999 per cent. In changing over a number of stations, it has been his experience that it is easier to get men to take undue risks than it is to get them to properly safeguard themselves. In reconstructing the power station at Connelsville, a 22-panel switchboard was moved bodily in two units by splicing out each wire and cable, leaving them lying loose, and then picking the section up with a crane and transferring it to its new location without interrupting service. All such construction work is exceedingly expensive and almost invariably more expensive than is shown by estimates.

W. O. Oschman described a fire in a transformer house, involving reconstruction work on outgoing feeders at 2,200, 10,000 and 15,000 volts, and requiring among other details, the sawing off of wooden insulator pins within a few inches of the live circuits.

K. C. Randall discussed some operating experiences in the tropics.

The annual banquet of the Pittsburgh Section will be held at the Hotel Schenley on February 8, at 6:30 p. m., and promises to be the most successful of these exceedingly enjoyable affairs, which has ever been held.

The list of speakers includes the following: H. E. Longwell, Westinghouse Machine Company, toastmaster; R. D. Mershon, president A. I. E. E.; Maurice Knowles, consulting engineer; Chancellor S. B. McCormick, University of Pittsburgh, and Walter Riddle, Sterling Varnish Company.

Niagara Falls Power Problem.

A board of army officers has been appointed by the Secretary of War to report upon the problem of the diversion of water from Niagara Falls, as well as the preservation of the scenic beauty of the cataract. This board consists of Mason M. Patrick, Francis K. Kernan, and Charles Keller.

The Burton Act, which controls the diversion of water to the American side of the Niagara River, and limits the amount of horsepower which may be transmitted into the United States from Canada, will expire by limitation March 4.

A fight is afoot to wrest control of the diversion of water from the Federal Government and vest it in the New York State Government.

That proposition is as strenuously opposed by the federal authorities, who maintain that the problems involved lie clearly within the jurisdiction of the War Department, which controls all navigable waters. The War Department meets the argument sometimes put forward by adherents to the idea of New York state jurisdiction, that the section of the Niagara River involved is not navigable, and therefore not under control of the War Department, with the counter claim that the Niagara River is an integral part of a great navigation system and cannot be considered separately.

The Burton law was enacted in 1906, and last August its life was extended to March 4, 1913. That act provides that the Secretary of War may issue permits for the diversion of an aggregate amount of water not exceeding 15,600 cubic feet per second, of which no one individual or company may use more than 8,600 cubic feet per second. The act likewise authorizes the Secretary of War to issue revocable permits for the transmission into the United States of electrical power generated in Canada to the limit of 160,000 horsepower, provided that amount, with that generated and used in Canada, shall not exceed an aggregate of 350,000 horsepower.

He is to allow the diversion of the waters to such amount "as, in connection with the amount diverted on the Canadian side, shall not injure or interfere with the navigable capacity of the river, or its integrity and proper volume as a boundary stream, or the scenic grandeur of Niagara Falls."

In 1910, four years after the first enactment of the Burton law, a boundary water treaty affecting the situation was negotiated between Great Britain and the United States. In agreeing that it was expedient to limit the diversion of waters from Niagara River so that the level of Lake Erie and the flow of the stream should not be appreciably affected, both parties sought to accomplish their object with the least possible injury to investments which already had been made in the construction of power plants under grants from the state of New York and the Dominion of Canada. That treaty authorized the United States to permit the diversion of not more than 20,000 cubic feet of water per second, while the Canadian Government was empowered to authorize the diversion of not more than 36,000 cubic feet per second. The larger concession was granted the Canadians as an offset to the privilege then, as now, enjoyed by the United States through the diversion of water from Lake Michigan for the Chicago drainage plan.

Commercial interests repeatedly have called upon the Secretary of War for permits to divert increasing amounts of water from the stream, and many hearings have been held before the House Committee on Foreign Affairs.

The latest of these hearings were held, at Washington, on January 22 and 23. A new bill, proposed by the subcommittee of the House Foreign Affairs Committee on Niagara Falls legislation, which was introduced in the House January 15, came up for consideration, and Attorney General Carmody, representing the State of New York, and others were heard in regard to it.

St. Paul Jovians Meet.

The first annual banquet of the St. Paul Jovians was held at the St. Paul Hotel on Friday, January 24, 1913. While given under the Jovian auspices many of the prominent electrical men of Minneapolis and St. Paul who were not Jovians had been asked. Over two hundred men sat down to the dinner, the tables for which were set in the form of the letter E. This is the largest gathering of electrical men ever held in the state of Minnesota, and reflects great credit on the Jovian Order of St. Paul.

Banquet of St. Paul Jovians.

The banquet was given in honor of Reigning Jupiter Watts of New York City, and other honored guests included the Governor of Minnesota, Adolph E. Eberhardt, Mayor H. P. Keller, of St. Paul; Mayor Wallace G. Nye, of Minneapolis. Paul Doty, of the St. Paul Gas Light Company, acted as toastmaster, and those at the speakers' table were: B. B. Downs, president St. Paul Electric Company; W. H. Vilett, member Eleventh Jovian Congress; A. Larney, sales manager Minneapolis General

Electric Company; E. Holcomb, manager Consumers Power Company, St. Paul; F. B. Thompson, president Northwestern Electric Equipment Company, St. Paul; C. E. Pack, manager, Minneapolis General Electric Company; W. G. Nye, mayor City of Minneapolis; F. E. Watts, Reigning Jupiter, New York City; Paul Doty, manager, St. Paul Gas & Electric Company; Governor Adolph E. Eberhardt, Minnesota; Mayor H. P. Keller, mayor of St. Paul; J. M. Hannaford, Jr., statesman for Minnesota; C. D. Wilkinson, manger Western Electric Company; H. J. Gille, assistant manager St. Paul Gas & Electric Company; Ludwig Kemper, manager Minnesota Gas & Electric Company, Albert Lea, Minn.

J. M. Hannaford, Jr., introduced Paul Doty as speaker of the evening and toasts were responded to by Governor Eberhardt, Mayor W. G. Nye, Mayor H. P. Keller, E. Kuhlman, No. 44, one of the charter members of the Jovian Order, Reigning Jupiter Frank E. Watts, of New York City, and C. E. Pack.

The Palm Room of the St. Paul Hotel was beautifully decorated for the occasion with electrical effects. A large electric sign illustrating the new Jovian emblem was hung in the nave of the fountain at the end of the room. Electric flowers and portables were used as table decorations. Each guest was furnished with a place card giving his name and address, and the menu was artistically gotten up in honor of the Reigning Jupiter and in keeping with the occasion.

Telephone Operation in Chicago.

At the weekly meeting of the Electric Club, Chicago, on January 23, an illustrated address was given by H. W. Foster, traffic superintendent of the Chicago Telephone Company, on "Some Things that Occur in the Operation of a Huge Public Utility."

Mr. Foster exhibited a large number of lantern slides illustrating the different portions of the plant of the telephone company and described the various operations incident to the installation of telephone apparatus and the furnishing of service. He pointed out the intimate relation between the operations in the telephone exchange and the daily life of a large city. He stated that there were in Chicago over 300,000 stations, from which about 2,000,000 calls were made every day. This number is greater than the daily average of calls in New York City, although the latter has about 30 per cent more stations. It requires 6,000 operators to handle the Chicago traffic and a separate exchange switchboard is maintained in connection with the school for their training. A daily load curve was exhibited, which showed that the calls were most thickly bunched at about 10 a. m.

Department-Store Lighting.

At the regular monthly meeting of the Pittsburgh Section of the Illuminating Engineering Society, held on January 24, the paper of the evening was on "Department-Store Lighting," by H. W. Shalling. It dealt especially with the new lighting system recently installed by McCreery & Company, Pittsburgh. At 6:30 p. m. the members of the local section and their friends were the guests of McCreery & Company at dinner, after which, through the courtesy of L. J. Kiefer, engineer for McCreery & Company, the store was lighted throughout and an opportunity was extended to examine the system in detail before hearing the paper.

The paper outlined first the problems usually encountered in the lighting of large department stores, taking up in detail later the requirements of the particular store discussed.

The choice between different systems and different lighting units is generally made on the basis of (1) relative efficiency; (2) relative attractiveness in appearance, all lighting systems being in general classed under direct, indirect of semi-direct.

In practically all lighting systems some portion of the illumination is received indirectly. When efficiency is important, it is the aim to make the indirect portion of the illumination small, allowing only enough light to reach the ceiling and walls to prevent a gloomy appearance.

A semi-indirect system possesses all the illumination advantages of totally indirect lighting; it is more attractive in appearance and avoids the unpleasant effect of a brilliant ceiling with no visible source of light. Experience has shown that the best degree of transmission of light occurs when the brilliancy of the light unit is approximately the same as that of the ceiling.

The disadvantages of the indirect lighting system as compared with the direct are: lower efficiency; more rapid depreciation due to dirt; a lower degree of perspective; and an unduly bright ceiling, which often gives an unpleasant psychological effect. In most cases the general illumination can be obtained more economically, efficiently, and with units which will be sufficiently attractive in appearance, by a system of direct illumination.

The advertising value or attractive power of a direct is far greater than that of an indirect system. Exposed light sources should not, however, be used for this purpose. The units should not attract attention from the goods displayed but should provide proper illumination at a reasonable expense, should be artistic in appearance and in harmony with the architectural surroundings.

Color Value.—The light units should approach as nearly as possible the color of natural daylight, so as not to distort the colors of the goods displayed. Certain classes of goods which will be used almost entirely under artificial light, should be sold under a similar type of artificial lighting. Tungsten lamps do not give the same color values as are given by daylight, but the approximation is close enough for most practical purposes.

Avoidance of High Intrinsic Brilliancy.—The avoidance of glare from exposed brilliant sources is essential. If inclosing opal or prismatic glassware be used, this effect is reduced practically to a minimum. Reflectors should be of a deep bowl shape so as to completely screen the lamp filament. It is advisable also that the lower portion of the bowl of the lamp be etched or frosted.

Uniformity of Illumination.—Reflectors which will effect the most desirable distribution of the light with a reasonable degree of uniformity should be selected. It is highly important to avoid objectionable shadows cast by a customer in standing before a counter.

Efficiency.—The reflector type of glassware is recommended wherever efficiency is of primary importance. Inclosing glassware is recommended where maximum attractiveness in appearance is more important than efficiency.

Cleaning and Maintenance.—In any first-class lighting installation, the reflectors or inclosing globes must be periodically inspected and cleaned, or the appearance and the illuminating efficiency of the installation will be seriously impaired.

The re-design of the lighting equipment of the McCreery & Company store was undertaken first, to improve the lighting by providing a higher intensity and more uniform illumination; second, to reduce the expense, and, third, to provide a modern and attractive installation. The building is 14 stories high, the inside area of the first floor being approximately 20,370 square feet and of the remaining floors, 17,850 square feet. The interior, including the fixtures, is finished in mahogany. The old equipment consisted for the most part of inclosed carbon arc lamps, with a considerable number of carbon-filament and a few tungsten incandescent lamps.

As a result of a careful investigation, tungsten lamps with various accessories, were decided upon for the different departments. All changes were made with practically no changes in wiring. One feature worthy of paricular attention is the fact that all the changes on each floor were made in a single night.

Mr. Shalling then went on to describe in detail the store-lighting system. In

general the lamps chosen were of the 250 or 400-watt size, and were completely inclosed in a reflector-ball type of unit, consisting of an upper prismatic reflector resting on a stalactite-shaped blown globe, the entire unit being satin-finished for the lower floor, and the bottom bowl only being satin-finished on the upper floors. A noteworthy feature of this globe is the fact that distributions approximating the well known extensive, intensive, and focusing distributions may be obtained by varying the position of lamp within the globe. A position was determined upon which would give an intensive distribution. A special feature of the lighting on the second floor was a small color-matching room completely shut off from the rest of the store and illuminated by an intensified arc lamp equipped with colored screens of such a value as to give almost exact daylight color, allowing ribbons, silks, etc., to be matched exactly. Carbon lamps could also be turned on to give the effect under artificial lighting conditions.

For the rug rack on the fifth floor, 25 outlets were provided on the circumference of a semicircle, having the same center as the rug rack, each outlet being provided with a 40-watt clear tungsten lamp and a 30-degree steel reflector having an aluminized interior surface. In general the intensity of illumination was varied to suit the type of goods being displayed, due consideration being given to the securing of ample side light wherever it was necessary.

On the second and seventh floors, devoted respectively to bedding and yard goods and men's clothing, a high intensity and a whiter light, allowing greater facility in the matching of colors, was secured by the use of lamps rated three volts below the circuit voltage, a life of 800 hours being secured under these conditions.

Show-Window Illumination.—The equipment consists of 60-watt clear tungsten lamps, the outlets being located on approximately 14-inch centers. Each lamp is equipped with a 100-watt size concentrating-type prismatic reflector; the units are mounted at an angle so that tip of the lamp is pointing at a line on floor approximately two-thirds of the distance to the opposite wall of window. The units are concealed from the view of persons standing on sidewalk by means of an ornamental drapery. The units are wired so that alternate lamps are on the same circuit, allowing one-half of the units to be used on ordinary occasions and all units when desired. The show cases are lighted satisfactorily by tungsten 25-watt tubular-type lamps.

Illuminometer test data were presented from a number of locations in the store, indicating very uniform and satisfactory intensities.

Cleaning.—A careful system for regular inspection and cleaning has been initiated in this store whereby all units in the building are brushed off with a stiff brush and cloth once every two weeks, and each unit is taken down and washed thoroughly once each month. The cost of cleaning, including labor and materials, is approximately $350 per year for approximately 1,000 units installed.

With the aforementioned changes, this store now has a thoroughly modern and attractive lighting equipment, and a considerably higher intensity of illumination at a saving in operating expense of over 50 per cent.

The discussion was participated in by G. H. Stickney, W. M. Skiff, C. H. Moore, L. J. Kiefer, Ward Harrison, A. L. Powell and S. B. Hibben. Mr. Stickney brought out the fact that a store of this type must be considered as a number of stores under one roof, each with its own separate illuminating problem to be solved, but with a system which will give a sense of unity throughout the whole. In many departments, attractiveness of appearance predominates over efficiency. Mr. Stickney personally did not agree with the statement that a semi-indirect unit should be equally bright with the ceiling, as he preferred to have it a little brighter—though recognizing that this is largely a matter of taste. He did not believe that it was ordinarily worth while to attempt to reproduce daylight colors; goods to be worn under artificial light should be purchased under such light. Moreover the tinted light from the tungsten lamp makes a store appear more pleasant, and the warmth introduced by the yellow color is ordinarily better than too close approximation to daylight, which tends to produce a cold, cheerless and rather irritating atmosphere. He commended the system of lighting of show cases for dresses, contrasting it with the too common arrangement of placing the lamps in the top of the case where they light only that part of the goods which it is impossible to see and leave the sides of dresses in the dark.

Mr. Skiff called attention to the reduction of the amount of heat liberated in the show cases by the substitution of tungsten lamps for carbon. Mr. Kiefer added that the McCreery Company had always been very economical in showcase lighting with the carbon lamps, as the great amount of heat liberated was very objectionable, and caused actual damage to certain types of jewelry.

Mr. Harrison stated that one-half the total depreciation with prismatic glassware is due to dirt on the outside of the reflector, and one-half to dirt on the inside of the reflector and on the lamp. By using a completely inclosing reflector, approximately one-half the total efficiency reduction is saved, and the efficiency is enhanced by the use of clear-bulb lamps, so that the total efficiency is nearly as good with the inclosing units as with the open bowl.

Mr. Powell stated that in small stores efficiency is the primary consideration. In large stores, such as department and large dry-goods stores, efficiency is necessary on account of the large areas to be lighted, but artistic appearance must also be considered, a balance being maintained between the two. In some shops where the profits are much higher they can afford to have the most inefficient systems, if they are especially attractive or unique. He called attention to the fact that in those departments where cut glass was on exhibition, a high intensity is necessary, and clear lamps are used with mirrored reflectors to produce as much sparkle as possible.

Mr. Hibben recommended the use of a satin finish for the upper half of the bowl on all the floors to reduce the rather harsh effect, and commended the high mounting of the units for the same reason. He commented on the use of a comparatively low general intensity in the department where portable lamps were on sale.

Mr. Shalling then answered a number of questions concerning details of the test data presented. He stated that the color values secured from the tungsten lamps burning at over-voltage was good enough for all except most exacting purposes.

Boston Automobile Show.

Plans for the Boston Automobile Show for 1913 are well under way. The date set for the opening of the pleasure car division is Saturday evening, March 8, and for the commercial-vehicle division, Wednesday, March 19. Each division of the show will continue a full week. The exposition of pleasure vehicles is under the auspices of the Boston Automobile Dealers' Association, and that of trucks under the auspices of the Boston Commercial Vehicle Association. Chester I. Campbell, who has managed previous shows, is in charge of both divisions of the coming exposition.

It is stated that nearly all the available space in Mechanics Building, where the show is to be held, has been engaged by exhibitors of cars and trucks, and dealers in accessories. The exhibit of electric automobiles will be very extensive. The electric motor-car manufacturers are said to be greatly interested in making as full and impressive a display of their product as possible and hope to overcome what they believe to be a tendency toward prejudice against the electric pleasure car and truck in New England, as indicated by the fact that they are less numerous there than in the western and central cities. The campaign of education that the dealers have been waging in Boston has already borne considerable fruit, and it is believed that some more hard work will result in popularizing the storage-battery vehicle, and bring it into high favor.

New Electrical and Mechanical Appliances

Model New Plant of H. W. Johns-Manville Company Starts Operation With New Year.

The completion of the new plant of the H. W. Johns-Manville Company, at Manville, N. J., marks another important chapter in the history of this enterprising concern.

Beginning with the consolidation of the H. W. Johns Manufacturing Company and the Manville Covering Company, in 1901, the H. W. Johns-Manville Company has grown by leaps and bounds until today it ranks as the largest concern in the world engaged in the manufacture of asbestos and magnesia products.

It has branch houses in practically every city of prominence in the United States and Canada, and representatives in almost all foreign countries. The company's other manufacturing plants are located in Brooklyn, N. Y., Milwaukee, Wis., West Milwaukee, Wis., Hartford, Conn., Nashua, N. H., Lockport, N. Y., Jersey City, N. J., and South Amboy, N. J. The asbestos mines at Danville, Quebec, Canada, are the largest in existence and acknowledged to produce the finest grade of asbestos known.

The new Manville plant consists of nine buildings, which, together with their products, are classified as follows: A—textile and packing; B—rubber plant, electrical specialties and printing department; C—pipe coverings; D—paper mill; E—magnesia; F—roofing; G—mastic and waterproofing; H—roofing coatings; power plant and pump house.

These buildings represent the most advanced ideas in fireproof construction, being of brick, steel and concrete, with roofs of J-M asbestos roofing. They are planned not only for safety, but to afford the best operating conditions for the employees. The "daylight" form of construction which is employed throughout permits a flood of light to enter the buildings through large triple-unit windows placed close together. The walls, ceilings and uprights are coated with J-M fireproof cold-water paint. Artificial illumination is provided in the form of J-M Linolite lamps and Frink reflectors.

The hygienic conditions of this plant are almost ideal. Healthful ventilation is furnished by means of steel ventilating sash, which provides a constant supply of fresh air without causing drafts. Owing to the judicious arrangement of the machinery, there is an entire absence of the crowding and confusion which, in many factories, serves to hamper the operators in their work.

Each building has an average length of 1,000 feet, and is a separate factory in itself capable of being operated as an independent unit without relation to the other buildings in the group. The total combined floor area of all the buildings is about 1,000,000 square feet.

Power is furnished by the company's power plant, which consists of the latest type of General Electric turbogenerators and six Babcock & Wilcox high-pressure water-tube boilers aggregating 5,000 horsepower. All steam pipes are insulated with J-M Asbesto-Sponge felted covering in order to effect a maximum saving of fuel. The power and lighting cables, instead of being strung on overhead poles, as is generally the case in factory installations, are led underground through J-M fiber conduit, thereby eliminating cable troubles for all time. The buildings are heated by exhaust steam conveyed underground from the power plant through pipes laid in J-M sectional conduit.

The new plant is located on a picturesque tract of 320 acres, divided by the Raritan River, in the town formerly known as Findern, N. J., but which name was recently changed to "Manville." The company's private railroad system, comprising five miles of tracks, connects directly with the Central Railroad of New Jersey, the Lehigh Valley Railroad and the Philadelphia & Reading Railroad, thereby insuring excellent shipping facilities. These railroads have made preparations to operate special work trains to and from Manville for the accommodation of employees who live in nearby towns. About 3,000 men will be employed at this new plant, making a total of about 7,000 who are now employed by this company.

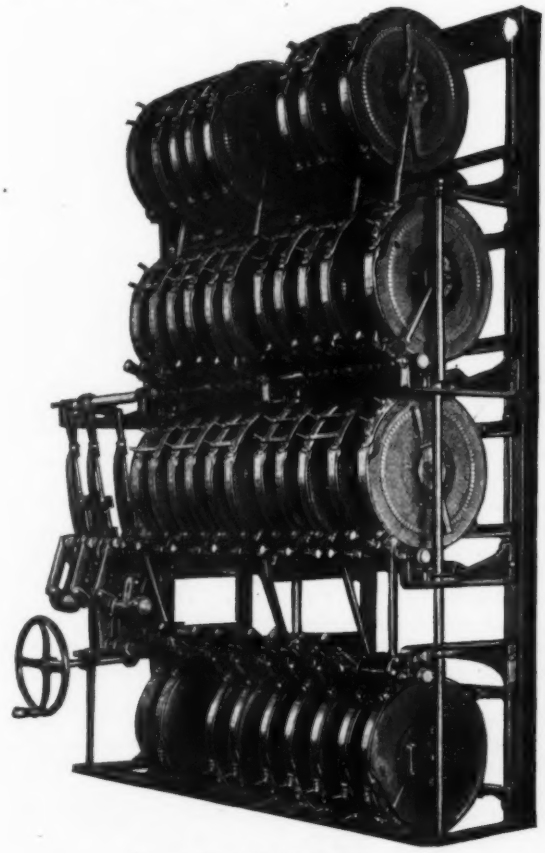
New Plant of H. W. Johns-Manville Company.

New Dimmer Equipment for Auditorium Theater.

The total capacity of lamps controlled by the new Cutler-Hammer dimmer in the Auditorium Theater, Chicago, and which was specially installed for the Chicago Grand Opera Company, amounts to 105,400 watts, the equivalent of 2,655 40-watt or 4,216 25-watt tungsten lamps. The new type duplex plates, having about double the steps of the regular C-H Simplicity plates, are used on this dimmer bank, an illustration of which is shown herewith. This type of plate made it possible to meet the peculiar requirements of this installation, and provide the large number of steps needed to secure very fine gradations of light and smooth, uniform dimming effects. It was desired to operate this bank in connection with a two-wire 110-volt system for a period of several months, but it also was specified that the same bank be capable of being used

in connection with a three-wire system, which system will be installed in the theater later. The new style of plate can be made with entirely independent windings on each side so that it was possible to lay out the dimmer bank for either a two-wire or three-wire circuit without increasing the number of plates. One plate can be provided with two separate and complete resistance windings, one on each side of the soapstone base. The contact levers, riding over the two separate sets of contact buttons can be arranged to operate independently, each under the control of a separate operating lever, or in unison under the control of one operating lever. It is thus possible to secure by the use of but one plate, not only a dimmer suitable for use with a two-wire circuit, but also two complete independent dimmers for use with two-wire circuits. It is also possible to obtain a three-wire dimmer by the use of a single plate. This proved an advantage in this particular installation as the space available for the dimmers was very small.

Three rows of operating levers are provided, one for the white, one for the red and one for the blue light dimmer, and each row of levers is under the control of a master lever. These masters are located at the left of the bank, side by side, making operation very convenient. A grand master handwheel is located directly below the master lever and provides for extremely slow motion. By means of the special link motion connecting this handwheel with the master lever, extreme refinements in control are obtainable. In addition to individual operation and master-lever control, the dimmers can be operated by the handwheel to secure very slow and gradual dimming. Any one row, or group of dimmers in that row can be operated in one direction to dim or brighten the lamps, while one or both of the other rows are operated in the opposite direction. This control is secured by means of the handwheel alone, making very realistic stage-lighting effects possible. The equipment was installed by the Cutler-Hammer Manufacturing Company, Milwaukee.



New Dimmer in Auditorium Theater.

Horton Electric Washer.

The Horton Manufacturing Company, of Fort Wayne, Ind., one of the pioneer manufacturers of washing machines, has placed on the market a new electric washer. This machine is specially built to meet the rapidly growing demand for a power washing and wringing machine. It is equipped with a steel-frame, reversible, five-year-guaranteed wringer. The main features of this machine are that it can be operated by hand, should anything happen to the motor or power supply, and that the wringer is fitted with a patented safety device to prevent injury to the fingers. The wringer can also be operated by hand, the momentum of the large flywheel making it much easier to operate than an ordinary hand-crank wringer.

All bearings are carefully machined and the entire machine runs practically noiseless. It also sets on four ball-bearing casters and is easily moved from place to place. The motor is a special washing-machine motor and of the highest grade obtainable. The wooden parts are all made of Louisiana red cypress, which is regarded as the best adapted wood for washing machines.

Horton Electric Washer.

Portable Insulation-Testing Galvanometer.

A new type of portable insulation-testing set is being placed upon the market by the Leeds & Northrup Company, 4901 Stenton Avenue, Philadelphia, Pa. The important features of the new set are sensitivity of the galvanometer, compactness, and ease of repairs of the galvanometer, should such repairs ever be necessary. The instrument is shown complete in Fig. 1 on the next page. It measures, when the box is closed, 9 inches by 4 inches by 4 inches. When the containing case is to be closed, the telescope, which is mounted on bearings, is lowered into a position parallel to the long axis of the box.

The sensitivity of the D'Arsonval galvanometer used is such that an electromotive force of one volt through a resistance of 20 megohms will cause

a deflection of one scale division. The resistance of the galvanometer is about 225 ohms, and its period about 2.5 seconds.

An Ayrton universal shunt and a standard 100,000-ohm resistance are mounted in the case with the galvanometer, making the set complete for insulation measurements, with the exception of the testing battery.

It is claimed that the galvanometer will withstand more rough usage than an ordinary voltmeter. Every galvanometer, however, no matter how

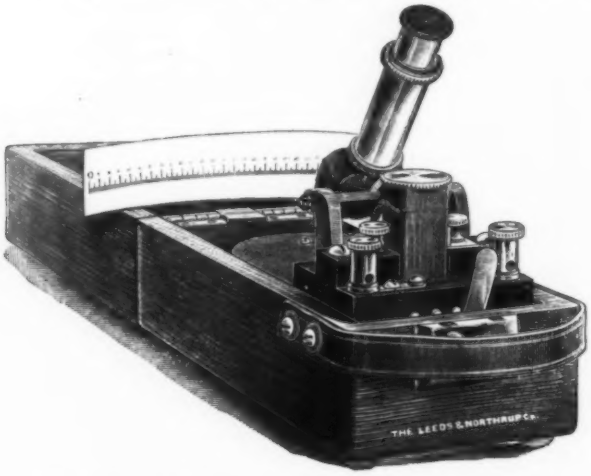


Fig. 1.—Complete Insulation-Testing Galvanometer Set.

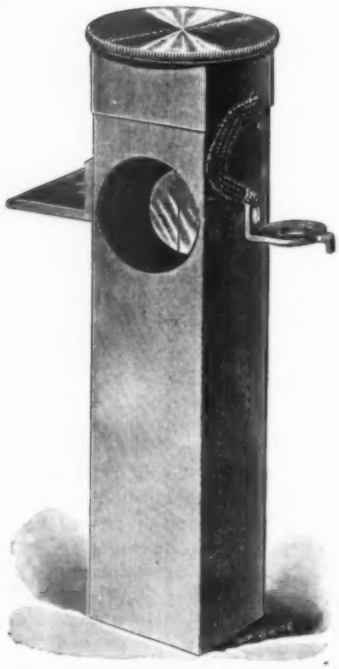


Fig. 2.—Separable Moving System for Galvanometer.

constructed, is liable to damage due to excessive jars. Although this instrument is particularly robust, special care has been taken in its design to simplify the question of repairs. A scheme of construction has been adopted which will allow of repairs being made at a minimum of cost and time. The moving system is contained in a separate unit. The top of this unit is shown directly beneath the telescope tube in Fig. 1 and separately in Fig. 2.

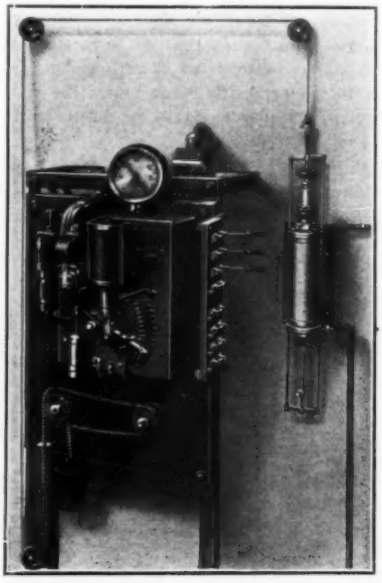
When in use it is put between the pole faces of the magnet, and secured by thumb screws. Should the system require repairing, this unit is removed from the instrument and sent to the makers by mail, its weight being less than four ounces. Upon its receipt, with an order for repair, it will be either repaired and returned within one day, or, if they are unable to return it immediately, a new unit will be sent, the units being interchangeable.

Economy in Electrically Controlled Draft Regulation for Steam Boilers.

To admit for boiler-room usage the use of the cheaper grades of anthracite coal, i. e., No. 3 Buckwheat, for example, which is much cheaper than No. 1 Buckwheat in general use, the Diehl Manufacturing Company, Elizabeth, N. J., has evolved a system of forced draft, electrically energized and automatically controlled, which necessitates only a comparatively small initial outlay for the smaller boiler room.

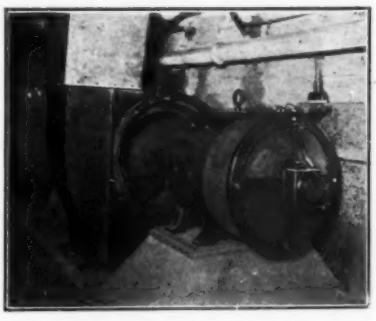
A multivane high-speed fan is utilized in connection with a variable-speed, steel-frame motor coupled direct on the shaft with a relief motor or steam engine ready to swing in on the other end in case of breakdowns. The motor is shunt wound and semi-inclosed with screens of wire mesh to guard against dust and dirt frequently found in the fire room.

The automatic action is as follows. Assuming that there is considerable natural draft over the fire and that the steam pressure is high, the damper-regulator piston is at the extreme end of its stroke, thus bringing the contact levers into the position shown, which stops the motor. As soon as conditions demand more steam, the regulator opens, which action transmitted through the chains connects the two circular contacts which close the clapper switch and operate the automatic motor starter, giving the minimum



Automatic Control for Draft Regulation.

speed available. The chains and sprockets transmit further movement of the damper regulator to the motor-field resistance attached behind the board and not shown, the contact lever traveling over a series of 60 contacts which movement increases the speed to any given point or maintains it on any one point, according to draft requirements. As the counterweight drops, the contact lever returns to the slow-speed or "Full Off" position. A series



Electric Forced-Draft Outfit.

of small limit switches is attached to the panel allowing the speed to be set for a maximum number of revolutions per minute.

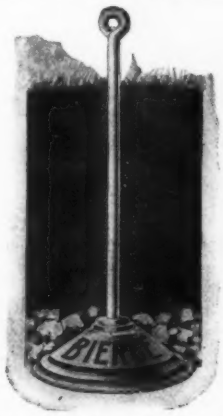
The cost and saving in a typical boiler room is given in the table on the next page.

Fan, engine and duct	$ 800
Motor	550
Controlling panel	125
Wiring and connecting	25
Foundation work	50
Total	$1,550

Allowing for the additional amount of the smaller coal consumed, a saving of 50 cents per ton or $7.50 a day was shown, the year's saving amounting to $2,737, or $2,644 net, after deducting six per cent interest on expenditure.

Bierce Anchors Withstand Severe Tests.

Some very severe tests on guy anchors were conducted a few months ago by a committee of engineers representing large telephone interests. These were made first on seven types of the best known patented anchors, of which all but one were of the eight-inch size, that were placed in the proper size hole six feet deep in soil consisting of three feet of black loam above three feet of solid clay. Difficulty was experienced in driving or properly expanding some of the anchors. On account of this difficulty of placing and because of their small holding power, several of the anchors were eliminated from later tests. In the second set of tests five anchors were subjected in the same soil to various pulls measured by a dynamometer; two of these anchors were eliminated after the second tests on account of deficiencies. The three remaining anchors were given a third test in a soil of fine damp sand.



Section Showing Bierce Anchor Installed.

In all these tests the Bierce solid anchor proved to be the best adapted to withstand severe strains. In one trial in the hard soil it resisted a pull of over 16,200 pounds, the breaking of the rope at this point causing the dynamometer to fall and break. It took six pulls to remove the anchor from the ground and when it came out the ground was disturbed over a circular area about 42 inches in diameter. As a result of the tests the Bierce anchor was adopted for use on the Bell telephone lines.

The construction of this anchor is shown in the accompanying illustration. It consists essentially of a solid inverted conical wedge made of very tough metal, to which any desired anchor rods are secured. The anchor itself is low in cost and is very easily installed. All that is necessary is to dig a hole not less than five feet deep by using an earth auger of the same diameter as the anchor. The latter is dropped into the hole and about one-half cubic foot of broken stone or brick is dumped on top of it and well tamped down. The hole is then filled around the rod with tamped or even loose earth. No driving, twisting or expanding is necessary. The wedge characteristic of the anchor enables it to grip the soil through the firm rock or brick immediately above it and the greater the pull the more firmly the wedge acts to oppose it. The eight-inch anchor has a direct bearing surface of about 200 square inches. Since ordinary earth will withstand a pressure of 50 pounds per square inch without any marked indentation, it is evident that the anchor can oppose a strain of 10,000 pounds before moving.

The Bierce anchors are made and sold by The Specialty Device Company, of Cincinnati, O.

Pass & Seymour, Incorporated, Holds Annual Sales Conference.

The annual sales conference of Pass & Seymour, Incorporated, was held at the main office and works at Solvay, N. Y., from January 15 to 18, inclusive. B. E. Salisbury, vice-president and general manager, presided, and there were a number of interesting papers and discussions. The sentiment of all of the representatives present was extremely optimistic regarding the outlook for 1913. The company made big gains during 1912 as against 1911, and it is expected that this showing will be improved upon during the current year. On the evening of January 16 everybody present was the guest of Mr. Salisbury at his home, followed by a theater party. Among those present at the conference were L. John Bergman, credit manager; John W. Brooks, secretary and director of exports; F. S. Baldwin, district sales manager, New York; V. R. Despard, district sales manager, Chicago; W. Brewster Hall, district sales manager, San Francisco; Frank T. Haffner, Frank Driscoll and John D. Raymond, Chicago office; George L. Hatheway, C. C. Heeb and W. E. Gould, New York office; and James S. Crossley, general superintendent.

Automatic Door Switch for Automobiles.

Such refinements as electric starters, electric lights, etc., have been added by the automobile maker now that they have become more or less standardized among the fundamental features of automobile construction. On electric lighting systems push-and-pull battery switches have been put to extensive use and now that the head, side and tail lights have been taken care of, the automatic operation of a lamp arranged to light the running board when opening the door has become an added feature on some cars. "Slow-break" switches have been tried, but they are not well adapted for this service, as, when the door is ajar part way, arcing occurs and destroys the contacts. The Cutler-Hammer Manufacturing Company, of Milawukee, Wis., has therefore adapted its standard "quick-make-and-break" automobile switch for automatic door operation by changing the operating bar and adding a yoke and spring.

This switch, known as No. 7195, and shown full size in the accompanying illustration, automatically closes the circuit and lights the foot lamp when the door of the vehicle is opened either when getting in or out, while closing the door causes the lamp to be automatically cut out of circuit. The small ingenious C-H mechanism makes possible a switch of small size, but having the high rating of 10 amperes, 80 volts. It is narrow and the rounded ends, which fit the holes made by an ordinary bit, make installation in the door jamb easy. The insulating material used in the body is both fireproof and waterproof and, unlike fiber, does not char or warp out of shape. The switch body and push bar are both unusually rugged.

Automatic Door Switch for Automobiles.

Ozonator for Railroad Station.

The Pennsylvania Railroad station in Pittsburgh, Pa., is to be equipped with an ozonator, requiring 1.5 kilowatts. The railroad has been experimenting with 15 small instruments in its offices and the officials have been pleased with the result.

The ozone will be fed through the regular ventilators of the waiting room. The quantity can be regulated according to the needs.

Twelve-Pole Sixty-Cycle Rotary Converters.

Typical of the successful and reliable operation of 60-cycle rotary converters, embodying modern departures in design for non-commutating-pole machines of this frequency, are two 1,000-kilowatt units installed in substation No. 1 of the Housatonic Power Company at Waterbury, Conn., and supplying power for railway service. Former standard practice for rotary converters of this capacity and frequency involved the construction of machines having 20 poles and operating at a speed of 360 revolutions per minute, but through refinement of design later machines have been developed with only 12 poles and operating at a speed of 600 revolutions per minute. During a period of approximately a year's constant service, these two 60-cycle units have demonstrated that they afford excellent commutation and operate efficiently under the usual fluctuating loads on railway systems.

These rotary converters are six-phase machines and operate in parallel with four 500-kilowatt, 60-cycle, six-phase converters previously installed in the same station, all of the apparatus being of the General Electric Company's manufacture. Three-phase current at a potential of 33,000 volts is received from the main power station of the Housatonic Power Company and transformed by six 350-kilowatt, oil-cooled transformers to 430 volts. The rotaries are started from the alternating-current side only and deliver direct current at 600 volts. The transformers have two 2.5 per cent. full-capacity taps below 33,000 volts and two similar taps above 33,000 volts in the primary, and one-third and two-thirds voltage starting taps in the secondary. They are designed with 15 per cent inherent reactance. The rotaries are compound wound and are built for standard carrying capacities of 150 per cent load for two hours, or 200 per cent load momentarily.

The magnet frame of the converters is made of cast iron and is divided horizontally. The two halves are held together securely by concealed bolts, which preserve the symmetry of the frame. Raised machined surfaces are provided on the inside for seating the pole pieces. The latter are made of laminated steel and are bolted to the magnet frame. The field spools can thus be repaired without dismantling the machine. Heavy copper dampers, forming a squirrel-cage winding, are inserted in the pole faces to prevent hunting and to assist in alternating-current starting. The field windings are wound in layers on spools, which are well insulated and have large creepage distances. Ventilating ducts are provided to insure cool running.

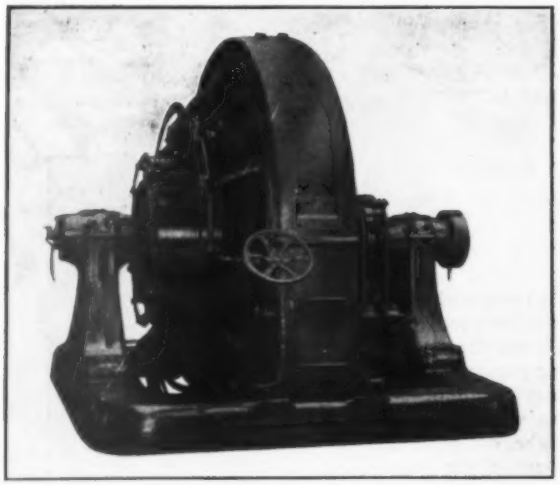
The laminations for the armature core are accurately punched. The laminations are assembled on an iron spider, and are held together and retained in position by flanges which clamp them. The holding bolts do not pass through the laminations. Ventilating ducts are provided at equally spaced intervals, which insures good ventilation of both the armature and field spools.

The armature winding is made up of formed bars, which are insulated before being assembled in the slots. The end windings are arranged so as to be thoroughly ventilated and are securely held in position by binding bands. No binding bands are placed over the core, the winding being retained by wooden wedges. Any unbalancing in the magnetic circuits is corrected by equalizer rings, mounted on the armature flange at the collector-ring end. They cause the direct-current brushes to take their proper proportion of current, thus helping to keep the commutator in good condition and to prevent "spotting."

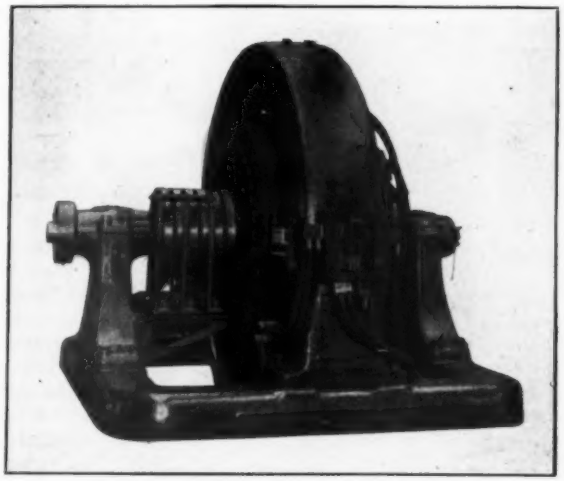
The commutator bars are of hard-drawn copper. The mica between is carefully selected both for insulating value and ability to wear evenly with the bars. The commutator is constructed so as to obtain an arching effect of the commutator bars and side mica, insuring tight side mica at all times. The bars are held in position by clamping rings secured by through bolts, which afford great latitude for expansion and contraction without affecting in any way the commutator surface. The rings are insulated over the ends to increase the insulation to ground.

The collector rings are made of a cast alloy, have ample radiating surfaces to insure cool running and are insulated with mica and horn fiber. They are mounted on a cast-iron shell, which is securely keyed to the shaft. The studs forming the connections between the collector rings and the collector leads are firmly screwed and soldered, and are amply supported to insure tightness under all conditions. The connections between the collector studs and rings are also securely bolted and soldered.

The brushes and brush-holders on the direct-current end of these machines are similar to those in successful use on other types of large direct-current apparatus. They are arranged so that they can be adjusted individually or collectively while the machine is in operation. Those employed on the collector rings are of improved design. "Metite" brushes are used, made by combining fine copper and graphite with suitable binders. They present the appearance of solid copper, are self-lubricating, and their use elimi-



Direct-Current End of Twelve-Pole Rotary Converter.

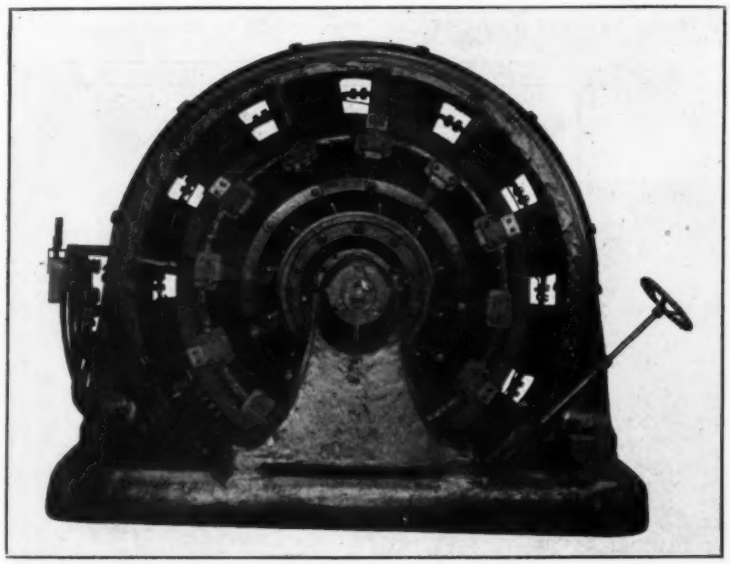


Alternating-Current End of Same Machine.

nates all cutting of the collector rings and the frequent cleaning which is necessary with the copper-leaf brush. They are provided with pig-tails, which are attached directly to the brush-holder supports.

As will be noted, the base, bearing pedestals and lower half of the magnet frame are all cast separately, permitting ample opportunity for adjustments. The bearings are of the self-oiling type, provided with large oil wells and are so proportioned as to assure cool running. The wearing surfaces are of babbitt and are renewable.

The machines are equipped with automatic magnetic end-play devices, which give reciprocating motion to the armature in a direction parallel to the shaft, and thereby cause the brushes to wear the commutator and collector rings more uniformly. Current



Another View of Direct-Current End of Machine.

for the operation of the device is obtained from the direct-current side of the converter. A condenser is connected across the make and break, to facilitate the opening and closing of the circuit.

For safe operation these converters are also equipped with speed-limiting devices for opening the circuit automatically in case the speed becomes too high. The device consists of a switch operated by a centrifugal governor. The centrifugal weight is mounted on the shaft and revolves with it, while the switch is stationary and is mounted on the collector-end pillow block. This weight is so designed that it operates at practically the same speed irrespective of the acceleration. Switch can be adjusted to operate at any predetermined speed, and is arranged to de-energize the low-voltage release coil on the direct-current circuit-breaker and thus open the circuit. The current-carrying parts are all stationary and so constructed that failure to operate is practically impossible when properly adjusted.

On the side of the frame is mounted a four-pole, double-throw, field-break-up switch for the shunt field. This opens up the field in several places to reduce the strain on the insulation caused by the high potential induced in the fields during alternating-current starting, and also provides a means of obtaining the proper polarity. The normal operating position of the switch is up. The down position is used for reversing the polarity of the machine when it comes up wrong from alternating-current starting. A single-pole, single-throw, equalizer switch and double-pole, single-throw, negative switch are also mounted on the frame.

In starting these machines alternating current is applied direct to the armature winding at a reduced voltage obtained from one-third and two-thirds voltage taps on the low-tension side of the transformers. After the machines have reached synchronous speed, the right polarity has been obtained and the fields have been excited on the first starting tap, two-thirds and then normal voltage is applied.

New Plant of the Connecticut Electric Manufacturing Company.

The Connecticut Electric Manufacturing Company has moved into a four-story building at Connecticut and Florence Avenues, Bridgeport, Conn., which has just been completed. For six years the company conducted its business at Bantam, Conn. It has been compelled through the rapid increase in its business to seek this new location, and now has every facility for prompt shipment of material. The factory is located on the main line of the New York, New Haven & Hartford Railroad, and has also excellent shipping facilities, Bridgeport being one of the most active shipping centers on the Atlantic Coast.

The company maintains offices at 50 Church Street, New York City, and at Paris, France, and the officers are: A. H. Trumbull, president; James Trumbull, vice-president; I. B. Trumbul, secretary and treasurer. The company manufactures complete lines of cutout bases for plug-type fuses, standard and weatherproof receptacles, weatherproof sockets, combination cutout switches and switches for plug fuses, knife switches, separable attachment plugs, and fuseless rosettes.

Telephone Dispatching on Oregon Electric Railway.

The latest electric railway system of the Northwest to adopt the telephone for dispatching its trains is the Oregon Electric Railway. This is an integral part of the great system of railways which reaches from the North Pacific coast to the Great Lakes, the Missouri and Mississippi valleys, comprising the North Bank Road, Oregon Trunk, Great Northern and Northern Pacific railways and the Burlington Route. The Oregon Electric line recently opened its new line from Portland to Eugene, Ore., and now has in operation that division and one from Portland to Forest Grove, Ore. The former traverses the heart of the famous Willamette Valley, which is the richest and most productive portion of the entire state of Oregon as far as agricultural resources are concerned.

The entire telephone train-dispatching apparatus with which the road is to be equipped will be supplied by the Western Electric Company. Two circuits will be equipped, one 40 miles long from Portland to Forest Grove and the other 125 miles long from Portland to Eugene. There are to be two train dispatchers both located at Portland.

The apparatus to be used includes two complete dispatcher's equipments comprising key cabinets and 45 calling keys in all besides the telephone sets, and 35 way-station equipments consisting of No. 102-B selector sets, containing the standard type No. 50 selector, and the new folding-gate type telephone bracket equipped with desk stands. Foot switches, vacuum and cutout arresters, and switch panels are also being furnished. Trains will be equipped with No. 1330-E portable telephone sets for use in communicating with headquarters from points between way stations. Each portable set will be furnished with line poles and plugs. The latter are to be used in connection with 50 type No. 186 jacks which will be installed at sidings along the right of way.

A New Departure in Switchboard Meters.

One of the widely accepted principles of scientific illumination is that only those parts should be illuminated that are desired to be seen. This principle has been utilized in a uniform line of seven-inch-dial, indicating switchboard meters recently placed on the market by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

A white mark on a black background is much easier seen than a black mark on a white background. Therefore these meters are supplied with black dials, the markings on which are white. Their particular field of application is in installation involving poor natural or artificial illumination. A white object causes a certain amount of halation which makes the mark on it appear larger. It also tends to blur dark lines on white dials and, as the eye tends to adjust itself to this condition, a certain amount of eye strain is found to result. Since a lens cannot adjust itself to such varying conditions, the photograph reproduced in Fig. 1 shows the black and white-dial meters under identical conditions of illumination, and from this it is an easy matter to determine the relative readability of the two types. Every possible precaution was observed during the taking of the photograph to insure an exact comparison, and the view well illustrates the difference in favor of the black dial. In actual switchboard practice, the pilot light would be equipped with a reflector but the comparative effect would be the same.

The switchboard shown in Fig. 2 consists of 16 marble panels, and is only slightly over 21 feet in length, due to the use of 16-inch panels. The smallness of the space occupied was rendered possible by the use of meters with seven-inch dials. The board is used to control two 340-kilowatt and one 500-kilowatt, 440-volt generators with exciters, one 1,000-kilowatt, 16,000-220-volt, three-phase transformer, and four 150-kilowatt, 440-220-volt, single-phase transformers, and five feeders.

As will be noted, all of the meters, including watt-hour meters, are of the black-dial and white-marking type. So popular has this new feature become since its introduction that a number of large operating companies have ordered the meters on their boards to be so equipped.

Fig. 1.—Contrast Between White and Black-Dial Meters.

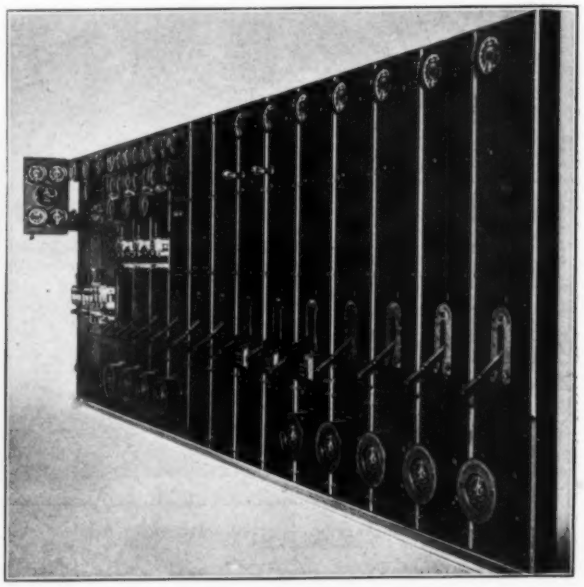


Fig. 2.—Switchboard With Black-Dial Meters.

Developments in Telephony and Telegraphy.

In the issue of the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN for January 4, in the course of the review of developments in telephony and telegraphy during 1912, the North Electric Company was referred to as having granted a license under its Clement auto-manual patents to the Western Electric Company. In that connection we published a statement that the North Electric Company acquired a license under all Western Electric automatic and semi-automatic patent rights. The arrangement between the two companies, we have been informed by the Telephone Improvement Company, was in the form of an exchange of patent licenses involving automatic and semi-automatic and auto-manual development work, and no other relationship exists between the two interests.

The North Electric Company has erected a modern factory at Galion, Ohio, which will be exclusively devoted to the production of auto-manual switchboards. The sales and engineering of this company will be conducted by the Telephone Improvement Company, which has recently opened offices at 1343-1352 Monadnock Block, Chicago, with an eastern office in the American Trust Building, Cleveland, O. This company announces that it has made no plans for leaving the independent telephone field. On the contrary, it has increased its facilities and its faith is pinned upon the ultimate success of the development of the independent telephone industry.

Improvement in Mazda Lamp Locks.

The E-Z Mazda lamp lock, which was described in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN of November 2, 1912, is designed to give insurance against theft of Mazda lamps. The lock is slipped on the socket or receptacle and cannot be removed without a special tool which can be purchased only from the maker or authorized selling agent by parties using the locks. This tool releases the lamp without the necessity of breaking it. When desired lead seals can be used and these must be broken before the lock can be released.

These locks have been improved and are now made of one piece of brass, insulated with heavy hard fiber bushings. This construction makes the locking device indestructible, giving many years of service and effecting a permanent saving through their use. This lamp lock is compact in appearance, and may be finished to match sockets or receptacles. The general sales agent is Fred Rall, 19 Park Place, New York City.

Current Electrical News

LIGHTING & POWER.

(Special Correspondence.)

MILNOR, N. D.—Citizens headed by Ole Hansen are agitating an electric lighting system. C.

MALVERN, IOWA.—Malvern Light & Power Company has been incorporated with a capital stock of $25,000.

ROCHESTER, N. H.—With the advent of spring a large power house is to be built by the Gonic Manufacturing Company.

SCOTT, KANS.—It is reported that this town has approved the proposition to issue $40,000 in bonds for a municipal electric light plant.

WILLIAMSPORT, IND. — The Town Board is preparing to ask for bids for the improvement of the municipal electric plant. S.

WESTBROOK, MINN.—Westbrook will have an electric light and heating plant. L. P. Pederson and Bert Milligan are backing the project. C.

ARGYLE, MINN.—Business men of Argyle, are agitating the installation of a decorative lighting system, similar to the one erected at Warren. C.

WAYLAND, IOWA.—The special election on the question of an electric light franchise resulted in favor of granting it. It covers light, heat and power. C.

NEWPORT BEACH, CAL.—The Board of Trustees have decided to build a distributing system, and to buy power instead of acquiring an electric light plant.

SACRAMENTO, CAL.—No bids were received by the City Commission for installing conduits for the electroliers of the city, so the city will do the work itself.

MODESTO, CAL.—The Sierra & San Francisco Power Company has been granted permission to run a power line along the county road between Oakdale and Claus.

MERCERVILLE, N. J.—The Public Service Electric Company will install an electric-lighting system through Hamilton Township, by way of Mercerville and Hamilton Square.

THOMASBORO, ILL.—President Kelso and other members of the Village Board inspected the electric light plant at St. Joseph, Ill., with a view to installing a similar system here.

BRYANT, ILL.—The Village Board has granted a 25-year franchise to the Canton Gas & Electric Light Company, of Canton, to operate an electric lighting system in the village.

MILTON, ORE.—A group of capitalists of this city are planning for the erection of a 2,000-horsepower hydro-electric power plant to be built on the Walla Walla River, seven miles from here.

KELSO, WASH.—The Washington-Oregon Corporation has been granted a franchise over the county roads between Castle Rock and this city for the construction of an electric light and power line.

GIDDINGS, TEX.—The Giddings Cotton Oil Company has purchased, at sheriff's sale, the electric light plant here, which was owned by H. M. Wolters. The company will enlarge and otherwise improve the plants. D.

SOUTH RIVER, N. J.—The Board of Works is considering the advisability of increasing the capacity of the municipal electric-lighting plant, in accordance with a report tendered by Superintendent Reid of the city plants.

PEKIN, ILL.—The Highway Commissioners of Groveland Township, have granted the Peoria Gas & Electric Company permission to use the highways for a line for electric light and power from East Peoria to Wesley City. Z.

BAY CITY, MICH.—Steps are being taken by this city to either install a municipal plant and generate electric power for its use or arrange with the Saginaw-Bay City Power Company for furnishing current for lighting Bay City.

BARDOLPH, ILL.—The Central Illinois Public Service Company has been granted a franchise to operate an electric lighting system by the Village Board and has been awarded a ten-year contract to light the village streets. Z.

TRENTON, N. J.—The City Commissioners and Merchants' Committee are considering the installation of additional ornamental lamps in the business district. The Public Service Electric Company is interested in the proposition. A.

STEELE, N. D.—The Council has granted permission to W. E. Hardy to place poles and wires for electric light service. Most of the business houses subscribed for lights. There will be enough power during the day time for small machinery. C.

EAST ST. LOUIS, ILL.—The Illinois Power Company has been incorporated with a capital stock of $100,000 to manufacture and deal in gas and electricity. The incorporators are Julian Laughlin, Phil Rehan and Herbert Charters. Z.

GILBERTVILLE, IOWA. — This city will have an electric light plant. A proposition has been submitted by the Waterloo, Cedar Falls & Northern Railway to furnish power for 12 cents per kilowatt, but business men are inclined to form a local company. C.

PRINCETON, IOWA.—Voters of the village have approved a proposition to grant a 25-year franchise to the Illinois & Iowa Railway Company to furnish electric light and power. The interurban company has purchased the municipal light plant for $732.44. Z.

SAN LUIS POTOSI, MEX.—The City Council has under consideration the proposition of installing a municipal light and power plant. The city's contract with the Central Mexican Light & Power Company has expired, and it is reported it will not be renewed. D.

MUSCATINE, IOWA. — Business men in this section entered into an agreement whereby they will establish a system of boulevard lighting on the north side of Second Street, from Iowa Avenue to Chestnut Street. Those interested are J. A. Bond, Earl Casper, A. W. Morgan and others. C.

TOPEKA, KANSAS.—An effort is being made to secure an appropriation from the Legislature for the purpose of overhauling the electric wiring in the State Capitol building. The city electrical inspector has issued a statement to the effect that the wiring is unsafe and a menace to the property.

LAMBERTVILLE, N. J. — The Lambertville Heat, Light & Power Company has passed into the control of F. Stanley North, Bay Shore, L. I., and associates. The new owners plan for extensions and improvements in the local plant and distributing system. T. F. Artell is manager of the company. A.

PITTSBURGH, PA.—The McKees Light, Heat & Power Company has filed articles of incorporation at Dover, Del. The company will manufacture electric current for light, heat and power purposes of all kinds. The capital stock is $150,000 and the incorporators are S. L. Lambert, G. G. Williams, of Pittsburgh, and Homer Lambert, of McKees Rocks.

LOUISVILLE, KY. — Contracts have been awarded the Falls City Construction Company for erecting a large factory which the Speedway Tire Company, a big new corporation, will occupy in the manufacture of automobile tires. The Falls City Construction Company will have charge of the purchase of a large number of electric motors to be used in equipping the plant. G.

ALEXANDRIA, IND.—The Indiana General Service Company, which was organized to supply light, heat and power to Alexandria and all adjacent towns and cities, has filed articles of incorporation with a capital of $500,000. The purpose is to build and equip a large electric plant and by means of transmission wires furnish current to such towns and cities. A. O. Hopper, C. L. Walling, H. M. Shank are the directors. S.

SALEM, N. J.—The Board of Public Utility Commissioners has granted permission for the consolidation of the Salem Electric Company and the Gloucester County Electric Company, with a new corporate name of the Electric Company of New Jersey. The

Board approves of an issue of bonds of $130,000 and stock of $24,000, the proceeds to be partly employed for extensions and improvements in the company's plan and system. A.

MURRAYVILLE, ILL.—The Village Board has granted a 50-year franchise to the Central Illinois Public Service Company to operate an electric lighting system in the village. Power is to be supplied by a transmission line from Roodhouse, and the system must be installed by January 1, 1914. A minimum rate of $1.00 is fixed. Residents of Manchester are circulating a petition to have the Central Illinois Public Service Company build a line to that place. Z.

OMAHA, NEB.—Improvements and extensions amounting approximately to $375,000 are contemplated by the Omaha Electric Light & Power Company for the year 1913. The plan as outlined includes an additional turbine engine and dynamo of 8,300 horsepower, a new condenser and two boilers of 500 horsepower each. There will be overhead construction not yet reached by the company's cables, additional meters, extensions of underground wires and a new intake from the river for water for the power plant.

CEDAR RAPIDS, IOWA.—United Light & Railways Company has completed plans for improvements on its various subsidiary properties in 1913, and something over $500,000 will be spent on new work, in addition to the regular appropriations for maintenance. Included in the new work will be a four-mile extension of the street railway lines at Cedar Rapids, with new equipment for the generating station, an addition of 12,500 horsepower to the generating station at Rock Island, a new coal gas plant at Ottumwa and the installation of a new condenser power plant at Fort Dodge.

TELEPHONE AN TELEGRAPH.

(Special Correspondence.)

VERNON, CAL.—Bids will be received up to February 18 for a telephone and telegraph franchise in this city.

BELVIDERE, ILL.—THE Belvidere Telephone Company will do much construction and repair work in the spring. Z.

ELDORADO, OKLA.—The Rural Telephone Association of Eldorado has been incorporated with a capital stock of $3,000 by T. A. Robinson and R. M. Springs, of this city.

WAYLAND, MICH.—Wayland Telephone Company has been incorporated with a capital stock of $10,000 for the purpose of building a telephone system in Grand Rapids, Mich.

MARCUS, WASH.—Marcus & Kettle Valley Telephone Company has been incorporated with a capital stock of $15,000 by C. W. Barringer, Glenn Sprague, and others.

NACOGDOCHES, TEX.—E. A. Blount has sold his local telephone exchange here to the Southwestern Telephone Company. The exchange will be improved and enlarged. D.

HARMONY, OKLA.—The Harmony Telephone Company has been incorporated with a capital stock of $1,000 by O. C. Bonham, J. N. Green, G. A. New, M. H. Vanderburg and L. L. Immel, all of Bruno.

CARTERSBURG, IND.—The Cartersburg Telephone Company has been incorporated with a capital stock of $1,250 by T. C. Kendall, Otto Lowe, H. E. Quinn, J. L. Graves and O. F. Stewarr.

LITTLE ROCK, ARK.—North Arkansas Mutual Telephone Company has been incorporated with a capital stock of $5,000. J. N. Ware is president and T. H. Henley, secretary of the company.

OKLAHOMA CITY, OKLA.—A charter has been granted to the Riverside Telephone Company with a capital stock of $250. The incorporators are John Woolf, F. E. Schuman and B. J. Kolesch. P.

PRAIRIE GROVE, ARK.—Farmers' Mutual Telephone Company has been incorporated with a capital stock of $10,000. J. M. Covett and A. N. Dean are president and secretary-treasurer respectively.

VERNON, N. Y.—The Vernon Telephone Company, incorporated, has been granted a charter with a capital stock of $10,000. The incorporators are F. H. Tygert, Anna W. Tygert and D. B. Case, all of this place.

NORFOLK, ARK.—The North Arkansas Mutual Telephone Company has been incorporated with a capital stock of $5,000. J. N. Ware is president; T. H. Henley, secretary, and S. J. Hutchinson, treasurer. Z.

CLIFTON, COLO.—Frank Paxson, of this city, is president of a new telephone company which has been incorporated with a capital stock of $48,000 for the purpose of competing with the Mountain States Telephone Company.

SIOUX CITY, IOWA.—The Sioux City Telephone Company has announced that it will do a large amount of underground and aerial cable work, and install additional plant equipment. Howard S. Baker is general manager of the company.

EVANSVILLE, IND.—Slaughter Avenue Telephone Company, recently incorporated to operate a plant in Knights Township, will receive bids for material and competent labor for the construction and equipment of a telephone plant.

BOONEVILLE, N. Y.—West Booneville Telephone Company, Incorporated, has filed articles of incorporation with a capital stock of $2,000. The incorporators are Samuel Dorn, Perry Tabald and Newton Gleasman, all of this city.

GREENVILLE, N. Y.—The Lambs Corners Telephone Company, Incorporated, has been incorporated with a capital stock of $240. The incorporators are Sheridan Palmer, Charles B. Rugg and Gaylord Lockwood, all of Greenville, N. Y.

SAN ANDREAS, CAL.—The Board of Supervisors is advertising for bids to be received up to March 3 for a franchise to maintain a telephone, telegraph and electric power line from Angels to the mining claim of Desire Friscot in Calaveras county.

GRIFFIN CORNERS, N. Y.—Fleischmann Telephone Company, has filed articles of incorporation with a capital stock of $25,000 for the purpose of operating a telephone line in and around several towns in this county. The incorporators are Charles V. Spriggs, Lillian T. Spriggs, Otis H. Todd, Louise M. Todd, Sarah C. Todd, A. H. Todd and George A. Speenburgh, all of Griffin Corners.

ELECTRIC RAILWAYS.

(Special Correspondence.)

HUNTINGTON PARK, CAL.—V. G. Kleinberger has been granted an electric street railway franchise in this city.

PHILADELPHIA, PA.—The Gettysburg & Hanover Traction Company, with $5,000 capital, was chartered in January. N.

WOODBRIDGE, N. J.—The Public Service Corporation will extend its electric railway system from this place to the Borough of Roosevelt. A.

WARREN, ILL.—It is reported that Southern Illinois capitalists are contemplating an electric railway paralleling the Illinois Central Railway from Warren to Freeport. C. F. Taylor, of Warren, is interested. Z.

RIGDEFIELD PARK, N. J.—At a special election, citizens have approved of a 50-year franchise grant for an electric railway system to the Public Service Corporation. The proposed line will be to Bogota and Teaneck, by way of Ridgefield Park. A.

ALTON, ILL.—The Alton & Eastern Railway Company has been incorporated with a capital stock of $2,500 to operate a street railway in Madison County. The incorporators are L. C. Haynes, A. J. Purinton, T. W. Gregory, O. C. Macy and R. C. Hardy.

GREENVILLE, ILL.—The Bond County Board of Supervisors has granted a franchise to the Springfield & Central Illinois Traction Company to use the highways of the country for its electric interurbans railway. The road must be built within two years from January 14, 1913. Z.

LAKE CHARLES, LA.—The Louisiana Traction & Power Company is making arrangements for extending its interurban electric line from Lafayette to Alexandria. This company is also said to be negotiating for the purchase of the lines of the Alexandria Street Railway Company in Alexandria. D.

PALESTINE, TEX.—The Dallas, Corsicana & Palestine Railway Company has been granted a franchise by the City Council for the occupancy of certain streets with its proposed line of railway. The company has given bond in the sum of $15,000 that it will comply with the provisions named.

BARTLESVILLE, OKLA.—Announcement is made that work will begin at once on a new interurban into this city by the Siggins Company, which now owns the lines between Cherryvale, Coffeyville and Independence, Kan. The line to Bartlesville is to run from Independence through Caney and Dewey. It is not expected that the local company at Bartlesville will permit the use of its tracks and the new company is now negotiating for right of way. P.

TERRE HAUTE, IND.—The Springfield & Central Illinois Traction Company has filed articles of incorporation with an orginal capital stock of $50,000. The object of this company is to build, equip and operate an electric line from the Illinois-Indiana state line through Vigo county to Terre Haute. Incidentally the company proposes to supply the towns and cities and also the numerous coal mines along the line with light and power. The directors are George Milan, William H. Neubauer, August R. Schultz and A. L. Lynch—all of St. Louis, Mo.

PROPOSALS.

ELECTRIC CONDUITS AND WIRING AND INTERIOR LIGHTING FIXTURES. — Sealed proposals will be received at the office of the Supervising Architect, Washington, D. C., until February 28 for conduits, wiring and lighting fixtures of a three-story building for the post office at Pocatello, Idaho; until March 1 of a one-story building for the post office at Frankfort, Ind.; Until March 5 of a two-story building for the post office at Grand Junction, Colo.; and until March 6 of a three-story building for the post office at Grafton, W. Va. Copies of drawings and specifications may be obtained from the custodians of the sites or from the office of the Supervising Architect.

ELECTRIC WIRE.—Sealed proposals will be received by the Navy Department, Bureau of Supplies and Accounts, Washington, D. C., until February 18 for the following electric wire:

Article.	Variety.	Quantity	Delivery at navy yard	Schedule
Cable	Ship lighting, portable	72,000 feet	Brooklyn, N. Y.	5152
Cable	Interior, communication	Miscellaneous	" " "	5153
Cable	Lead covered, single conductor	"	" " "	5152
Cable	Double braided, varnished cloth insulated	"	Philadelphia, Pa.	5152
Cable	Steel wire, copper clad	60,000 feet	Brooklyn, N. Y.	5153
Conductor	Silicon bronze	3,000 feet	" " "	5153
Conductor	Triple, silk	9,000 feet	" " "	5153
Conductor	Flexible, silk	60,000 feet	" " "	5153
Cord	Lamp, incandescent	72,000 feet	" " "	5152
Cord	Telephone	45,000 feet	" " "	5153
Wire	Bell	300,000 feet	" " "	5153
Wire	Lighting and power, single and duplex	Miscellaneous	" " "	5152
Wire	Magnet	"	Eastern	5153
Wire	Single conductor, plain	"	Brooklyn, N. Y.	5153
Wire	Telephone, twister	12,000 feet	" " "	5152
Wire	Twin conductor, plain	Miscellaneous	" " "	5153
Wire	Weatherproof	"	" " "	5152

FOREIGN TRADE OPPORTUNITIES.

(Parties interested in the following items should address the Bureau of Foreign and Domestic Commerce, Washington, D. C., and refer to the file number noted.)

NO. 10,284. ELECTRIC PUMPS.—The municipality of Chalons-sur-Marne, France, invites tenders for electric pumps at the city waterworks. Particulars regarding these pumps may be obtained of the mayor.

NO. 10,276. GENERATING STATION.—The Federal Swiss Railways, Berne, Switzerland, will receive tenders for the construction and equipment of a generating station at Amsteg, at an estimated cost of $60,000.

NO. 10,267. ELECTRIC CARS AND EQUIPMENT. — A report from an American consul states that for the municipal street railway the local city authorities have approved the purchase of 22 electric cars. They are provided with seats for 18 and standing room for 30 persons, and the seat backs are to be reversible. Other cars and trailers will be needed from time to time, and it might be well for American manufacturers to file propositions with an office named in the report.

NO. 10,273. ELECTRIC LIGHT AND POWER SUPPLY.—The American legation at Montevideo, Uruguay, has forwarded the original and translation of a bill recently sanctioned for the State monopoly of electric light and power supply in that country. It is stated that tenders will be called immediately for 15 power houses, plans for which have already been drawn up.

NEW INCORPORATIONS.

WAPELLO, IOWA.—Wapello Electric Company has been incorporated with a capital stock of $25,000.

TONASKET, WASH.—People's Telephone & Power Company has been incorporated with a capital stock of $15,000 by residents of this place.

LITTLE ROCK, ARK.—The Pocahontas Light, Power & Ice Company has been incorporated with a capital stock of $25,000. The incorporators are W. H. Skinner, Ben A. Brown and S. A. D. Eaton.

CHICAGO, ILL.—The Eastern Iowa Electrical Company has been incorporated under the laws of South Dakota with a capital stock of $1,000,000 for the purpose of taking charge of dams, water rights, etc., generally.

NEW YORK, N. Y.—S. Rosenberg Electric Company, Incorporated, has filed articles of incorporation with a capital stock of $1,000. The incorporators are Selig Rosenberg, Julius Vogel and Joseph Schwartz, all of New York City. This firm will do electrical work.

BROOKLYN, N. Y.—Morgan-Fusco Company, Incorporated, has filed articles of incorporation with a capital stock of $3,250 and will manufacture and deal in gas and electric fixtures, etc. The incorporators are Maurice L. Fusco and Joseph Abrams, New York, N. Y.

BROOKLYN, N. Y.—Bachlet Magnetic Wave Company, Incorporated, has filed articles of incorporation with a capital stock of $25,000. The incorporators are Walter L. Vaughn, Gertrude A. Dickson and Charles Dampf, of Brooklyn, N. Y. This firm will deal in electrical goods.

NEW YORK, N. Y.—Falkenbach Manufacturing Company, Incorporated, has filed articles of incorporation with a capital stock of $30,000 and will manufacture gas and electric-light fixtures. The incorporators are Edward Falkenbach, Andrew P. Traber and Agnes Traber, all of New York City.

NEW PUBLICATIONS.

SEA VOYAGE OF A DRY DOCK.—An account of the voyage of the dry dock *Dewey* to the Philippines, written by W. J. Aylward, has been published by John A. Roebling Sons' Company. The article is reprinted from *Scribner's Magazine*, with illustrations.

AUTOMATIC TELEPHONE PATENTS.—A pamphlet entitled "The Patent Situation in Automatic Telephony," by F. Aldendorff, has been published in German, by the press of S. Heimann & Sohn, in Berlin. It demonstrates that the automatic-telephone situation in Germany is not dominated by one firm controlling patents on the important features, as generally believed.

BUREAU OF MINES.—The second annual report of the Bureau of Mines for the year ended June 30, 1912, has appeared. The past work of the Bureau is described and its needs for the future stated. Among the investigations carried on are those dealing with accidents from electricity, mine lighting and electrical investigations concerned with safeguarding life and property.

SMOKE ABATEMENT.—The Bureau of Mines has issued bulletin No. 49 entitled "City Smoke Ordinances and Smoke Abatement," by Samuel B. Flagg. This considers the status of smoke-abatement work in the United States, and considers the 28 larger cities in detail. A proposed form of smoke ordinance is given. An appendix contains verbatim the ordinances of Chicago, Pittsburg, Des Moines, Milwaukee, Los Angeles, and Boston.

STREET-RAILWAY TRAFFIC IN SAN FRANCISCO.—Preliminary report No. 19 has been made by B. J. Arnold to the Board of Supervisors of the city of San Francisco, Cal. It deals with the growth of traffic and investment in transit facilities. In addition to an analysis of past and present growth, the report contains a prediction of traffic and necessary service in the future. Diagrams help to emphasize the meaning of the statistics.

ELECTRICAL METERS IN EUROPE.—The Bureau of Foreign and Domestic Commerce has issued a report by H. B. Brooks, dealing with the manufacture of electrical instruments and meters in Europe. Mr. Brooks recently spent a year abroad, during which time he inspected 31 of the most important works in England, France, Germany and Italy. The products of each concern are treated in detail and descriptions given of buildings, equipment, materials used, labor conditions, etc.

KEOKUK DEVELOPMENT.—Bulletin No. 8 has been issued by the Mississippi River Power Company. It describes progress on the hydroelectric development at Keokuk, Iowa, on the Mississippi River, up to December, 1912. The piers and arches of the dam have been joined to the power house. The erection of three turbines is about complete. The superstructure for the electrical equipment is described. A portion of this equipment is already in place. The bulletin is copiously illustrated.

MANUFACTURING IN PHILADELPHIA.—The Philadelphia Commercial Museum has issued a bound volume descriptive of manufacturing in Philadelphia from 1683 to 1912, prepared by John J. Macfarlane, librarian. The aim is to give those not familiar with the city a correct idea of the city's industries, whose magnitude is seldom realized. The volume is illustrated with photographs of a number of the leading establishments, and brief histories are given of certain industries, in which Philadelphia leads. Out of a total of 8,379 establishments, 45 are devoted to electrical machinery, apparatus and supplies, and 41 to gas and electric fixtures, lamps and reflectors. There are also car shops.

FINANCIAL NOTES.

In accordance with the reorganization plan the Federal Court has ordered the sale of the personal property and real estate of the Allis-Chalmers Company, February 27, following the previously announced sale of the company's main property under bondholders' foreclosure February 3.

At the annual meeting of the H. W. Johns-Manville Company a resolution reducing the number of directors from nine to seven was approved. Retiring directors, with the exception of George W. Gladwin, were re-elected. A vacancy already existing in the Board reduced it to the required number.

C. D. Parker & Company, of Boston, who are interested in a number of electric light and power, street railway and gas properties in Massachusetts, have secured a financial interest in the Amesbury Electric Light Company, Bowen Tufts, of the firm, was elected a member of the board of directors.

Directors of the Kellogg Switchboard Company are planning a 50 per cent increase in the capital stock. The shares, according to the present plan, will be issued to the stockholders at par. The capital is now $1,000,000. In January, 1910, it was $500,000 and at that time was increased by a stock dividend of $500,000. The company pays dividends at the rate of 12 per cent, and the new shares will be put out to meet the expansion in business.

Stockholders of the New England Power Company have voted to increase the capitalization of the company from $1,500,000 to $3,250,000 by the issuance of 17,500 additional shares of six-per-cent cumulative preferred stock. The new stock is to be issued at par to the preferred stockholders under such conditions as the directors may set forth. The stock of the company will be divided into 7,500 shares of common and 25,000 shares of preferred after the new stock has been issued.

The Consolidated Gas, Electric Light & Power Company has filed an application with the Public Service Commission of Maryland for permission to issue $6,360,054 of new common stock to be used in retiring an equal amount of the preferred stock, the common to be exchanged for the preferred share for share. The company still has in its treasury $699,054 of common stock, which has not been put out and which the company has authority to issue.

The proceeds from the sale of $100,000 five-per-cent first-mortgage bonds by the Cape Breton Electric Company, Ltd., of Sidney, Nova Scotia, it is said, will be used for extensions and improvements to the properties of the company. It is stated that the company is earning more than two and one-half times its bond interest. There are $1,500,000 of bonds authorized, $988,000 being outstanding.

The recently closed fiscal year of the General Electric Company was the best in the history of the corporation. Sales totaled close to $85,000,000, compared with $70,383,854 in 1911, and about $71,500,000 in 1910. In 1912 the company earned a net in about the same proportion to the sales billed as in the previous year. Thus the net was about $12,400,000, equal to close to 16 per cent on the $77,757,200 stock outstanding last year. This compares with 13,66 per cent earned in 1911 on $77,335,200 stock, and 16.63 per cent in 1910 on $65,179,600 stock. The General Electric Company now has the largest volume of unfilled orders on its books of any time in its history.

Negotiations which have been opened between H. M. Byllesby, president of H. M. Byllesby & Company, Chicago, and Mayor William O. Head, of Louisville, Ky., promise to lead to the merger of all electric and gas utilities in the Gateway City under Byllesby management. The effect of this action will be the introduction of fuel and illuminating gas at 35 cents per thousand feet in Louisville in the near future. The saving which would be afforded the municipality at the present rate of consumption, present prices upon gas being 72 cents per thousand feet, would be more than half a million dollars annually. Mr. Byllesby paid a visit to Louisville last week. He advised Mayor W. O. Head that it would be impossible for his company to supply the fund of $3,000,000 necessary to pipe natural gas from the West Virginia wells of the Standard Oil Company to Louisville unless municipal opposition to the merger of the Kentucky Electric and Kentucky Heating Companies, with corporations now owned in Louisville by the Byllesby's, is withdrawn. Mayor Head will probably consent to the move, in view of the fact that a flat 35-cent rate for fuel gas is in prospect. The Byllesby interests are said to hold an option upon the Louisville Lighting companies, and will exercise this option as soon as a franchise is given to enter with the pipe line. The absorption of the Kentucky Electric Company may then follow.

Dividends.

American Railways Company; a dividend of 1.75 per cent on the preferred stock, payable February 15 to holders of record January 31. This is the first dividend on this stock, $2,000,000 of which was recently issued.

Fort Worth Power & Light Company; a quarterly preferred dividend of 1.75 per cent, payable February 1 to stock of record January 20.

Illuminating & Power Securities; a quarterly preferred dividend of 1.75 per cent, payable February 15 to stock of record January 31.

Kellogg Switchboard & Supply Company; a stock dividend of 25 per cent, payable to stock of record January 28; and a quarterly dividend of three per cent, payable February 3 to stock of record January 3.

Monongahela Valley Traction Company; a semi-annual preferred dividend of 2.5 per cent, payable February 1 to stock of record January 27.

Pacific Gas & Electric Company, the regular quarterly dividend of $1.50 per share on the preferred stock, payable February 15 to stock of record January 1.

Reports of Earnings.

EDISON COMPANY OF BOSTON.

The Edison Company, of Boston, reports as follows for December, and six months ended December 31, 1912:

	1912.	1911.
December gross	$ 655,562	$ 582,140
December net	415,928	376,593
Six months' gross	3,020,126	2,770,126
Six months' net	1,628,700	1,625,131

BANGOR RAILWAY & ELECTRIC COMPANY.

Bangor, (Me.) Railway & Electric Company, for November, 1912, and the five months ended November 30, 1912, reports earnings as follows

	1912.	1911.
November gross	$ 61,681	$ 50,234
November net	34,313	29,166
November surplus	17,074	16,484
Five months' gross	325,536	277,082
Five months' net	187,620	157,573
Five months' surplus	103,512	92,901

PORTLAND RAILROAD COMPANY.

The Portland (Me.) Railroad Company for November, 1912, and the five months ended November 30, 1912, reports earnings as follows:

	1912.	1911.
November gross	$ 76,071	$ 72,068
November net	18,273	18,177
November surplus	8,019	8,481
Five months' gross	473,222	470,615
Five months' net	181,179	169,396
Five months' surplus	129,491	121,622

UNITED LIGHT & RAILWAYS COMPANY.

The consolidated earnings statement of the subsidiary companies of the United Light & Railways Company for the month of November and five months ended November 30, 1912, compares as follows:

	1912.	1911.
November gross	$ 421,431	3382,739
November net	183,176	151,461
Surplus after charges	102,875	71,661
Five months net	1,997,443	1,813,910
Five months net	873,613	754,900
Surplus after charges	484,166	358,718

The income account of the United Light & Railways Company proper for the five months ended November 30, 1912, follows:

Earnings available on stocks owned of subsidiary companies	$473,335
Miscellaneous income	57,692
Total income	531,028
Expenses, interest, etc	157,392
Surplus	373,636
Preferred dividends	163,225
Surplus	210,411

Earnings of the subsidiary companies applicable to securities of the United Light & Railways, together with other income, for the same periods are as follows:

November gross, $108,764; November net, $73,948; November balance after preferred dividends, $41,293; five months gross, $531,027; five months net, $373,635; balance after preferred dividends, $322,849.

CLOSING BID PRICES FOR ELECTRICAL SECURITIES ON THE LEADING EXCHANGES AS COMPARED WITH THE PREVIOUS WEEK.

	Jan. 27.	Jan. 20.
American Tel. & Tel. (New York)	133	133
Commonwealth Edison (Chicago)	141½	139
Edison Electric Illuminating (Boston)	281	280
Electric Company of America (Philadelphia)	12	12
Electric Storage Battery common (Philadelphia)	53½	53
Electric Storage Battery preferred (Philadelphia)	53½	53
General Electric (New York)	141½	141⅝
Kings County Electric (New York)	129	129
Manhattan Transit (New York)	1	1
Massachusetts Electric common (Boston)	17	16⅝
Massachusetts Electric preferred stamped (Boston)	75½	71½
National Carbon common (Chicago)	115	115
National Carbon preferred (Chicago)	117½	117¼
New England Telephone (Boston)	157	156½
Philadelphia Electric (Philadelphia)	23½	22⅝
Postal Telegraph and Cables common (New York)	81	80
Postal Telegraph and Cables preferred (New York)	67	67⅝
Western Union (New York)	72	70¾
Westinghouse common (New York)	72¾	74
Westinghouse preferred (New York)	118	118

*Last price quoted.

PERSONAL MENTION.

EDWARD G. ACHESON, American inventor and scientist, has been made an honorary member of the Imperial Technological Society.

M. W. PULLEN, formerly graduate student at Massachusetts Institute of Technology, is now assistant in applied electricity at Johns Hopkins University.

ALBAN W. MANN, of Elgin, Ill., has been appointed supervising engineer of the 78 plants of the Central Illinois Public Service Company, of Mattoon, Ill.

G. J. JOHNSON has resigned as manager of the properties of the Central Telephone & Telegraph Company at Paxton, Ill. He is succeeded by T. D. THOMPSON.

GEORGE F. BATTERTON, auditor for the past two years of the Western States Gas & Electric Company, Richmond, Cal., has been transferred to the Louisville Gas Company.

A. W. COURNYER, of Milwaukee, Wis., has been appointed superintendent of the Sterling, Dixon & Eastern Railway Company, to succeed DEAN TREAT, who has resigned.

C. D. PENNISTON, recently named as general manager of the Wisconsin Gas & Electric Company, Kenosha, Wis., and E. R. Walton, superintendent of construction for the company in Kenosha, have resigned their positions.

H. W. JEFFERS, FRANK ADAMS, J. V. D. WYCKOFF AND WALTER GROVER have been elected respectively, president, vice-president, secretary and treasurer of the Farmers' & Traders' Telephone Company, of Plainsboro, N. J.

N. C. DRAPER, manager of the Sioux Falls Light & Power Company, Sioux Falls, S. D., was recently elected a director of the Commercial Club of that city, and at a subsequent meeting Mr. Draper was elected vice-president of the organization.

FRANK F. FOWLE announces that he has severed his connection with the McGraw Publishing Company as one of the editors of the *Electrical World* and will resume his electrical engineering practice, with offices at 68 Maiden Lane, New York City.

E. B. KORST, who for nearly two years has been manager of the New Business Department of the Ottumwa Railway & Light Company, Ottumwa, Iowa, has resigned to accept the district superintendency of the Central Illinois Public Service Company.

THOMAS A. EDISON was a guest of honor at the second annual banquet of the Edison Club at the Lyceum, East Orange, N. J., on January 18. This club is composed of the employees in the offices and executive branches of the Edison Works at West Orange.

GEORGE L. HOXIE, mechanical and electrical engineer, Montclair, N. J., has been suggested as a member of the Board of Public Utility Commissioners, to fill the vacancy occurring on May 1 in the New Jersey State Board, in a petition presented to Governor Wilson recently.

WOODS HUTCHINSON, the eminent author and lecturer, addressed the students of the Commercial School of the New York Edison Company on the evening of Wednesday, January 29, at the Edison Auditorium, New York. The subject was "Efficiency and Health."

A. F. NESBIT, until recently professor of physics, New Hampshire College, is now electrical engineer in the department of industrial research, University of Pittsburgh. Professor Nesbit is on the staff in charge of the smoke investigation which is being carried on by the University.

OSCAR T. CROSBY has resigned the presidency of the Wilmington & Philadelphia Traction Company, of Philadelphia, Pa., and disposed of his interest in the corporation to devote more of his time to the Trenton & Mercer County Traction Company, Trenton, N. J., of which he is the president.

L. C. WHITCHER, who is division superintendent of traffic of the Boston Division of the New England Telephone & Telegraph Company, addressed the Boston Plant Chapter of the Telephone and Telegraph Society of New England on Friday evening, January 24, on the subject of "Handling Telephone Traffic."

H. O'BRIEN, special agent of the telegraph department of the New England Telephone & Telegraph Company, delivered an address on the subject of "The Future of the Telegraph Profession" before the Western Union Chapter of the Telephone and Telegraph Society in Edison Hall, Boston, Mass., on January 23.

G. WILBUR HUBLEY and SAMUEL RIDDLE, chief engineer and superintendent of transportation, respectively, of the Louisville Lighting Company, Louisville, Ky., were elected members of the directorate of the Louisville Engineers' and Architects' Club for the ensuing year. FRANK H. MILLER, superintendent of motive power of the same company, was elected chief executive of the Club for 1913.

D. C. GREENE, manager of the Oregon Power Company, Marshfield, Ore., as president of the Marshfield Chamber of Commerce, represented that body at Washington, D. C., recently, for the purpose of securing an additional appropriation for the improvement of Coos Bay Harbor, and reports the successful issue of his mission. On his way west Mr. Greene spent several days visiting the Chicago office of H. M. Byllesby & Company.

T. S. McLOUGHLIN, author of "Questions and Answers on the National Electrical Code," the first edition of which has been exhausted, although only recently placed on the market, has entirely recovered from a rather serious throat operation which he underwent some time ago. Mr. McLoughlin now looks the picture of health and is engaged in electrical engineering, with offices in the Hibernia Bank Building, New Orleans, La.

CHARLES T. MAIN, consulting engineer, Boston, Mass., has been awarded the contract for the engineering work in connection with the development of the Big Falls of the Missouri River, near Great Falls, Mont., and Thompson Falls, on Clark's Fork, of the Columbia River. The surveys of these developments have started. It is probable that the Big Falls development will have a capacity of 125,000 horsepower and the one at Thompson Falls, 50,000 horsepower.

ALEXANDER SHANE, Columbus, Ind., has resigned as general manager of the Indianapolis, Columbus & Southern Traction Company, to take new and higher service with the Interstate Public Service Company. His duties will be with the newly organized Bureau of Safety, which will cover liability insurance and make a well organized campaign for the prevention of accidents. The Bureau will have headquarters in Chicago, but Mr. Shane will retain headquarters in Indianapolis.

A. T. MACDONALD, sales manager of the Louisville Lighting Company, Louisville, Ky., has been appointed chairman of the Committee on Fireworks for the celebration of the one-hundredth anniversary of the victories of Commodore Perry, which is to take place on Lake Erie next July. Judging from the pronounced ability which Mr. Macdonald has displayed in everything from running a big newspaper to directing the sales policy of a large central station, there will be no lack of pyrotechnics to make the audiences on the Lakes stop, look and listen.

H. C. WORTHEN has been appointed general manager of the Southern Division of the Western Union Telegraph Company, with headquarters in Atlanta, Ga. His appointment, along with others, comes as a result of the new policy of the Western Union in conducting its business under three separate heads. J. R. Terhune, of Nashville, Tenn., has been appointed Western Union district superintendent in charge of Kentucky, Tennessee and Mississippi. H. J. Carpenter has been made district traffic superintendent and W. K. McClarin, district plant superintendent, both with headquarters in Nashville. H. H. Kirkpatrick is assistant to Mr. Terhune, at Nashville, and C. H. Carroll is the newly-appointed district commercial manager, having supervision over Kentucky, with offices in Louisville with Local Commercial Manager Charles Smith, who retains that position.

OBITUARY.

WILLIAM J. DENVER, who until six months ago had been assistant general manager of the New England Telephone & Telegraph Company for 27 years, died on January 20 at his home in Florence, Mass. Mr. Denver was a native of Springfield, Mass., where he was born in August, 1841. He early learned telegraphy and at 16 years of age became an operator at Bellows Falls, Vt., afterward being employed in New Haven, Northampton and Springfield. In Springfield he became manager for the Western Union Telegraph Company in 1864. In the seventies, when the Bell Telephone Company sought to enter Springfield, Mr. Denver held the rights of that company in Hampden and Hampshire Counties, but through conflicting interests with the Western Union was obliged to relinquish them. Through his efforts, however, the Western Union opened a telephone exchange in Springfield. Later Mr. Denver opened exchanges in Boston, Providence and Worcester. After the sale by the Western Union of its telephone business to the Bell Company, Mr. Denver turned again to telegraph activities, but in 1885 became assistant general manager of the New England Company. He was a director of the American Bell Telephone Company, the New England Telephone & Telegraph Company and the Southern Massachusetts, Maine, Aroostook, Coos and Franklin County subsidiaries.

DATES AHEAD.

Thirteenth Annual National Automobile Show. Chicago, Ill., February 1-15.

Electrical Supply Jobbers' Association. Quarterly meeting, Buffalo, N. Y., February 11-13.

National Independent Telephone Association. Annual convention, Chicago, Ill., February 18-20.

American Institute of Electrical Engineers. Midwinter convention, New York, N. Y., February 26-28.

Central Electric Railway Association. Annual meeting, New Washington Hotel, Indianapolis, Ind., February 27-28.

Minnesota Electrical Association. Annual convention, St. Paul, Minn., March 11-13.

American Electrochemical Society. Spring meeting, Hotel Traymore, Atlantic City, N. J., April 3-5.

Mississippi Electric Association. Annual convention, Natchez, Miss., April 21-23.

Iowa Electrical Association. Annual convention, Waterloo, Ia., April 23-24.

Association of Railway Telegraph Superintendents. Annual meeting, St. Louis, Mo., May 20.

National District Heating Association. Fifth annual convention, Indianapolis, Ind., May 27-29.

National Electric Light Association. Annual convention, Chicago, Ill., June 2-5.

National Electrical Contractors' Association. Annual meeting, Chattanooga, Tenn., July 16.

With the Electrical Manufacturers

Hazard Manufacturing Company, Wilkes Barre, Pa., maker of bare and insulated wire for every purpose, has issued an attractive wall calendar for the present year. It contains a large illustration of the *Olympic* coming into port.

The Duplex Metals Company, Chester, Pa., has issued a circular with several illustrations of the use of Copper-Clad wire on the high-tension lines of the Beacon Light Company, Delaware County, Pa. The experience of this company with this wire is also set forth.

Rome Wire Company, Rome, N. Y., has issued a folder entitled "Copper History," giving the monthly average price of copper for the years 1883 to 1912, inclusive. This shows a fluctuation from 9.25 up to 26 cents, the yearly average varying from 9.5 to 21.2 cents. The average price in 1912 was 16.7 cents.

H. R. Wilson Machinery Company has been organized with offices at 1100 New Bank of Commerce Building, St. Louis, Mo., to conduct a general second-hand electric and steam machinery business. The president of the company is H. R. Wilson, who was associated for a long time with the firm of Arthur S. Partridge, of St. Louis.

Pass & Seymour, Incorporated, Solvay, N. Y., has issued bulletin No. 766, which shows in a simple yet forcible manner how it is possible to make 24 sockets and receptacles from 15 stock parts. These parts are interchangeable and when remade into another type of socket or receptacle the parts remaining can be assembled for still other types.

McGill Manufacturing Company, Valparaiso, Ind., has issued its 1913 catalog of electric specialties, which comprise chiefly a large variety of wire lamp guards notably the Loxon, Gripson, and other protector lamp guards, portable lamp guards, reflector lamp guards, trouble finders, cord adjusters, soldering materials. lamp-coloring and frosting fluids. lamp adjusters, etc.

The Western Electric Company, New York, N. Y., made its public debut as a distributer of "Pittsfield" automobile supplies at the New York Automobile Show, which opened at Madison Square Garden on January 11. The Western Electric "Pittsfield" exhibit showed a complete line of magnetos in operation, switches, storage batteries, timers, spark plugs and other ignition devices.

The Electric Controller & Manufacturing Company, Cleveland, O., through C. A. Pirtle, vice-president and sales manager, has presented to the Department of Electrical Engineering of the University of Illinois, an automatic controller for electric motors. The apparatus in question is of elaborate design, and it constitutes an important addition to the equipment of the University's electrical laboratory.

The Economical Electric Lamp Works of the General Electric Company, 25 West Broadway, New York, N. Y., announces a heavy demand and a great many repeat orders from central stations, jobbers and contractors for the Hylo-Economical drawn-wire Mazda turn-down electric lamp. These turn-down lamps are furnished in voltages of 100 to 130, and are made in pull-string, turn-bulb and long-distance types.

Minneapolis Heat Regulator Company, Minneapolis, Minn., has issued some circulars describing its electric heating regulator outfits. Each of these sets includes a handsome thermostat, with or without clock attachment. The thermostat controls a motor which actuates the regulating mechanism. In one of the circulars are shown typical temperature charts, contrasting the temperatures obtained without and with the equipment.

The Bryan-Marsh Electric Works of the General Electric Company, Chicago, Ill., has greatly enlarged its industrial lighting department to handle the rapidly increasing business coming to this important branch of Bryan-Marsh work. The department, under the direction of J. A. Munroe, has greatly increased the scope of industrial illumination in factories and manufacturing plants of every description in many parts of the country.

The Sanford Riley Stoker Company, Limited, of Worcester, Mass., has been recently organized for building and selling the new Riley self-dumping underfeed stoker. The company is backed by well-known business interests and ample capital. The officers are: President, R. Sandford Riley, formerly president of the American Ship Windlass Company, builder of the Taylor stoker; treasurer, Aldus C. Higgins, secretary and counsel of the Norton Company; secretary, George N. Jepson, works manager of the Norton Company.

Sprague Electric Works of General Electric Company, New York City, has issued pamphlet No. 117, which briefly illustrates and describes the leading Sprague products. Among these are direct-current generators, motors and switchboards, alternating-current motors, drive and control equipments for newspaper presses and other printing machinery, electric hoists, direct-current fans and exhaust fan outfits, electric dynamometers, Greenfielduct, Greenfield flexible steel conduit, B X cable, conduit outlets, switches and fittings.

American Sheet & Tin Plate Company, Pittsburgh, Pa., has issued an illustrated book entitled "Better Buildings." This contains not merely a catalog of the company's formed metal roofing and siding materials, but also a large number of illustrations showing the variety of buildings for which these materials are suitable. There is also included much valuable information of use for builders. These roofing and siding materials are made both in corrugated and as smooth sheets, and have plain, galvanized or tin finish.

Sunbeam Incandescent Lamp Works of General Electric Company, Chicago and New York City, has issued a fourth revised edition of a 22-page booklet entitled "How to Figure Illumination." The object of this bulletin is to acquaint the general public with the most simple and modern methods of figuring commercial and industrial illumination. It also includes a complete catalog of Sunbeam Mazda lamps. Copies of this bulletin can be had upon application to any of the offices of the Sunbeam Incandescent Lamp Works, or to any of the distributing houses of the Western Electric Company.

The Diehl Manufacturing Company, Elizabethport, N. J., in an announcement in the January 18 issue of this journal, inadvertently called attention to the Diehl eight-inch "ceiling" fan.

The word "ceiling" was inserted in error, and there was no intention to be misleading. The company has bought 12.5 acres of property lying partly in Elizabeth and partly in Newark, N. J. This will be utilized as the site for factory No. 2. A large influx of business during the past few years has caused the company to outgrow its present works at Elizabethport. Next spring, therefore, a new factory will be built upon the site just acquired to accommodate the increasing business. The frontage of the property is 832 feet along Newark Avenue, and it extends a depth of 630 feet to the line of the Pennsylvania Railroad, along which there is a siding to give excellent shipping facilities.

The Blaw Steel Construction Company, of Pittsburgh, Pa., has received an order for the fabrication of 3,000 tons of steel transmission towers from the Pearson Engineering Corporation, of New York. The towers will be shipped to Spain, where they will be used in work being carried on there by the Ebro Irrigation & Power Company. A like order for 575 tons of towers was also taken by the Riter-Conley Manufacturing Company, of Pittsburgh. The Blaw Company also received an order for 200 tons of transmission towers to be used by the Stone & Webster Engineering Corporation, at Keokuk, Ia., in the Mississippi River hydroelectric development being carried on there.

Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., reports that among the many recent orders received the following are notable: Long Island Railroad Company, New York City, for 27 equipments of No. 308 railway motors and type AB control (in addition to 75 similar equipments already in service). Santa Barbara Consolidated Railway Company, Santa Barbara, Cal., 10 double equipments of No. 337-C-3 motors and type HLF control. Union Traction Company of Indiana, substation equipment as follows: three 3,000-kilowatt commutating-pole rotary converters, seven 400-kilowatt, three 110-kilowatt, six 100-kilowatt 33,000-volt transformers, five switchboards and switching equipments. Worcester Consolidated Street Railway Company, Worcester, Mass., nine 300-kilowatt and two 2,000-kilowatt rotary converters, twelve 110-kilowatt and six 700-kilowatt 13,200-volt transformers. Edison Electric Illuminating Company, Brooklyn, N. Y., one 1,000-kilowatt rotary converter, three 367-kilowatt transformers and switchboard.

General Electric Company, Schnectady, N. Y., announces that among the variety of orders for generating and power apparatus recently received were the following: Shelburne Falls power Company, Shelburne Falls, Mass., six 2,000-kilowatt and one 1,500-kilowatt, water-cooled transformers, one 615-kilowatt transformer, one 100-kilowatt motor-generator set, one 150-horsepower motor and switchboard panels; Pennsylvania Water & Power Company, Holtwood, Pa., a 225-kilowatt motor-generator set with exciter and switchboard apparatus; Georgia Power Company, Atlanta, Ga., three 3,333-kilowatt transformers, 40 disconnecting switches, a seven-panel switchboard, etc.; Tennessee Power Company, Ocoee, Tenn., two 9,375-kilowatt generators with exciters, two 9,375-kilowatt transformers, one 50-kilowatt motor-generator set, switchboard apparatus, etc.,; Eastern Michigan Power Company, Jackson, Mich., two 2,220-kilowatt, one 438-kilowatt and one 500-kilowatt generators, one 125-kilowatt regulator, 133 transformers from 1 to 100 kilowatts for the distribution system, four 200-kilowatt and two 300-kilowatt transformers, five switchboards, etc.; Great Western Power Company, San Francisco, Cal., two 12,500-kilowatt generators, one 500-kilowatt exciter and switchboard apparatus; The Burbank Company, New York City, for power plants in connection with irrigation work, two 300-horsepower and two 150-horsepower motors, three 350-kilowatt transformers and switchboard apparatus; Minneapolis Thrashing Machine Company, Hopkins, Minn., for factory drive 46 motors, ranging from ½ to 100 horsepower, three 150-kilowatt transformers, switchboards, etc.; Zier Oil Company, San Francisco, Cal., 18 motors, ranging from 6 to 20 horsepower, with oil switches and six 25-kilowatt transformers; Niagara Alkali Company, Niagara Falls, N. Y., two 750-kilowatt, six-phase, regulating-pole, rotary converters, two 800-kilowatt, water-cooled transformers and switchboards; Knickerbocker Portland Cement Company, Hudson, N. Y., 18 motors, ranging from 10 to 200 horsepower; Hooker Electro Chemical Company, Niagara Falls, N. Y., 1,540-kilowatt, six-phase, regulating-pole rotary converter, one 1,650-kilowatt transformer and switchboard; Republic Rubber Company, Youngstown, O., a 1,000-kilowatt, mixed-pressure Curtis turbogenerator; The St. Lawrence Talc Company, Natural Bridge, N. Y., six 150-horsepower motors, three 300-kilowatt transformers, oil switches, etc.; Pennsylvania Cement Company, Bath, Pa., a 250-kilowatt synchronous condenser, 16 motors, ranging from 10 to 250 horsepower and a switchboard; Carnegie Steel Company, for the Edgar Thompson Steel Works at Bessemer, Pa., a 3,500-kilowatt Curtis turbogenerator; Brier Hill Steel Company, Youngstown, O., two 1,000-kilowatt Curtis turbogenerator units with 35-kilowatt motor-generator exciter sets, also 121 motors ranging from 3 to 150 horsepower; John A. Roeblings Sons Company, Trenton, N. J., a 500-kilowatt Curtis turbogenerator unit with switchboard; Pittsburgh Crucible Steel Company, Midland, Pa.; four 500-kilowatt, two-unit motor-generator sets, four 50-kilowatt generators, one 1,600-horsepower motor and switchboard apparatus.

Record of Electrical Patents.

Issued by the United States Patent Office, January 21, 1913.

1,050,780. System and Apparatus for Recording Electrical Signals. W. W. Alexander and T. Keim, Denver, Colo.; said Keim, administrator of said Alexander, deceased, assignor to Protective Signal Manufacturing Co. A clock-controlled device for recording telegraph messages on a sheet.

1,050,791. Releasing Mechanism. C. E. Beach, assignor to G. O. Knapp, New York, N. Y. Is operated by an electromagnet and armature.

1,050,796. Process for Separating Vanadium from Uranium. W. F. Bleecker, assignor to Standard Chemical Co., Pittsburgh, Pa. Includes electrolysis as one step in the process.

1,050,799. Igniter for Gas Engines. S. F. Briggs, assignor to Briggs & Stratton, Milwaukee, Wis. Of the make-and-break type.

1,050,812. Indicator for Automobiles. D. Dann, Chicago, Ill. A direction-indicating hand is swiveled so that when it turns it closes an electric lamp circuit.

1,050,824. Fire-Alarm. J. E. Goodwin, Cumberland Gap, Tenn. Melting of a fusible connection closes the alarm-circuit switch.

1,050,827. Timer for Electric Welding Machines. J. A. Heany, Washington, D. C. A relay controls the time that the welding circuit remains closed.

1,050,830 Trolley. E. P. Hinchberger, Pittsburgh, Pa. Circular guard plates project beyond the edges of the wheel.

1,050,885. Terminal for Electric Wires. G. R. Welch, Detroit, Mich. A spring clip is rotatably secured to the ferrule at the end of the cable.

1,050,887. Storage Battery. J. D. White, Niagara Falls, N. Y. The jar has a flanged rim forming a continuous recess about its top, into which the flange of a closure plate fits.

1,050,893. Terminal for Battery Plates. T. A. Willard, assignor to Willard Storage Battery Co., Cleveland, O. Creepage of acid upon the binding posts is prevented by surrounding them with rubber vulcanized directly to the post.

1,050,894. Automatic Refrigerating System. E. T. Williams, Brooklyn, N. Y., and H. T. Bernhard, West Hoboken, N. J. Includes a motor-driven compressor and electric valves and pressure means controlling the same.

1,050,908. Trolley Mechanism. L. R. Barker and E. C. Dietrich, Riverton, Kans., assignors of one-third to S. E. Gard. For swinging the trolley pole forward and backward and for holding it in mid position.

1,050,910. Automatic Control Device for Refrigerating Apparatus. F. Bishop, assignor to Auto-Electric Refrigerating Co., Chicago, Ill. Thermostatic and pressure control for the motor driving the compressor.

1,050,912. Electric Resistance. F. Bolling, Frankfort-on-the-Main, Germany. A heating unit for flatiron with several strips of resistance ribbon arranged in zigzag form.

1,050,937. Safety Appliance for Railway Platforms. R. C. Gallinant, Ridgefield Park, N. J. Electric valve control for the compressed-air cylinder operating the sectional guard platform.

1,050,939. Automatic Single-Pole Electric Switch. W. F. Gorton, St. Joseph, Mo., assignor of one-fourth

each to R. E. Creel, G. H. Wyatt, and H. A. Osborn. Has line, motor and switch contacts, a disk and operating lever.

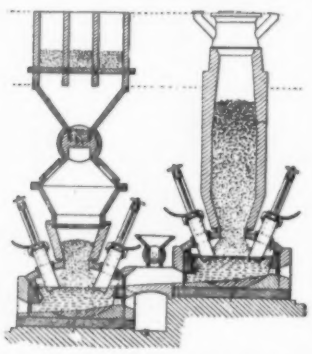
1,050,960. Electrical Reciprocating Mechanism. J. C. Lincoln, assignor to Lincoln Co., Cleveland, O. A plunger reciprocates in the center of a solenoid with many transverse sections synchronously controlled in advance of the plunger.

1,050,967. Light Shield. W. N. McComb, New York, N. Y. A color cap closely fitting about the tip end of an incandescent lamp.

1,051,009. Trolley Harp. G. W. Rickard and E. C. De Voe, Dayton, O. The top of the pole has a rearwardly extending bracket that holds the fork at right angles to the pole.

1,051,035 Method of Making Transparent Quartz Glass. A. Voelker, Beuel, near Bonn, Germany. Quartz tubes are electrically formed and remelted and drawn out twice, the last time in an oxy-hydrogen flame.

1,051,036. Electric-Resistance Melting-Furnace. A Voelker, Beuel, Germany. Consists of a central carbon rod and carbon tube between which the quartz tubes are heated.



1,051,065.—Electric Smelting Furnaces.

1,051,060. Apparatus for Electrolyzing Liquids. E. Balke, assignor to Siemens & Halske, A. G., Berlin, Germany. The vessel has a number of compartments, the liquid passing through each in turn.

1,051,065. Electric Smelting. G. H. Benjamin, New York, N. Y. After the iron is smelted in an electric stack furnace and the carbon and phosphorus removed, it is run into an electric converting furnace in which the requisite amount of carbon is added.

1,051,091. Electric-Railway Safety Device. E. J. Dunne, Jersey City, N. J. A. signal and derail device associated with a draw bridge.

1,051,098. Alternating-Current Rheostat for Polyphase Circuits. W. H. Gaulke, assignor to Independent Electric Manufacturing Co., Milwaukee, Wis. Has three parallel rows of contacts over which three resistance-bridging contact yokes can move in unison.

1,051,109. Telephone System. E. R. Hobbs. Buhl, Ida. Provides for continuous energization of the cut-off relays at the exchange.

1,051,113. Telephone. P. L. Jensen and E. S. Pridham, assignors to Commercial Wireless & Development Co., San Francisco, Cal. A receiver with main-line coil mounted in the air gap of a strong magnetic field.

1,051,118. Telegraphic Recording Instrument. E. T. Keim and W. W. Alexander, Denver, Colo., assignors to Protective Signal Manufacturing Co. The impression member is moved step by step transverse to the movement of the magnet's armature.

1,051,120. Process of and Furnace for Securing Products Formed in Gases at High Temperatures. C. F. R. von Koch, Stockholm, Sweden. The gas is subjected to an electric arc.

1,051,131. Apparatus for the Endothermic Reaction of Gases. W. S. Lee, Charlotte, N. C. Two adjacent cylindrical surfaces with electrical connections to a circuit are rotated in opposite directions.

1,051,133. Fire and Burglar Alarm. C. Liaci, New Haven, Conn. Mechanical and electrical features of the alarm box.

1,051,147. Storage-Battery Plate. W. M. McDougall, East Orange, N. J. Has a thin sheet of lead on each side of which are insulating grids holding the active material.

1,051,148. Selective Signaling System. J. McFell, Chicago, Ill. Includes an electromagnetically controlled and clock-operated pole-changer.

1,051,156. Organ-Tuner's Keyboard-Player. M. J. Olson, Ishpeming, Mich. Has a series of electromagnetic connectors and a motor-operated actuator.

1,051,194. Process of Effecting Reduction and Producing Ferrosilicon. E. A. Byrnes, assignor to Electric Metallurgical Co., Chicago, Ill. The lower portion of the furnace is electrically heated.

1,051,219. Push-Button Electric Switch. H. E. Grabau, New York, N. Y. Operates an oscillating switch plate through an extension rod.

1,051,228. Elapsed-Time Electric Signal. C. Hirdler, Oklahoma, Okla. Displays a signal when the telephone has been used for a certain time limit.

1,051,234. Illuminated Sign. W. R. Huston, Gadsden, Ala. Each letter unit is illuminated from the interior and has light-reflecting openings.

1,051,238. Electrical Regulating Apparatus. C. Lamboeuf, assignor to Société Alsacienne de Constructions Mécaniques, Belfort, France. Separate excitation for a generator is provided by a booster with differential fields.

1,051,245. Electric Advertiser. L. Marchal, Chicago, Ill. A hinged supporting clamp for a sign.

1,051,259. Dynamo-Electric Machine. W. H. Powell and R. B. Williamson, assignors to Allis-Chalmers Co. The rotating field has longitudinal ventilating ducts open to the air gap at the middle and to the end castings of the machine at the radially innermost ends.

1,051,261. Electric-Storage-Battery Plate. A. Ricks, Gross Lichterfelde-Ost, Germany. The active material includes lead oxide, electrolytically formed lead, an albuminous substance, and hardening agent composed of sulphuric acid and phenol.

1,051,262 to 1,051,264. Railway Signaling System. A. Rioux, Nashua, N. H. These three patents involve various features in a system that includes a special signaling trolley wire and a signal trolley on each car or train.

1,051,270 and 1,051,271. Selective Signaling System. H. O. Rugh, assignor to Sandwich Electric Co., Sandwich, Ill. Both patents relate to the selective signal-receiving devices at the different stations which include a step-by-step element.

1,051,349. Electrotherapeutical Apparatus. A. W. Neitro, Seattle, Wash. The body is placed on a couch, rolled into a casing and subjected to the combined action of many discharge electrodes and electric lamps.

1,051,363. Generator. E. Anderson, New York, N. Y. Electric ignition.

1,051,370. Novelty Cane or Umbrella. T. Hertz, assignor to Brooklyn Wireless & Electrical Novelty Co., Brooklyn, N. Y. Has dry cells in the hollow stem and a miniature lamp in the handle.

1,051,373. Inductor Generator for Ignition Purposes. J. L. Milton, Chicago, Ill. Has a cross-shaped rotating inductor.

Patents That Have Expired.

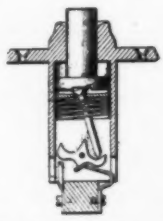
Following is a list of electrical patents (issued by the United States Patent Office) that expired January 28, 1913:

553,528. Lightning Arrester. E. G. W. C. Hoffman, Charlottenburg, Germany.

553,529. Method of Electrical Propulsion for Street or Other Cars. J. Jackson, Clinton, Ia.

553,535. Telegraph Repeater. B. F. Merritt, Newark, N. J.

553,538. Rheostat. W. H. Morgan, Alliance, O.



1,051,219.—Push-Button Switch.

553,552. Electric Railway Conduit. A. Beck, Atlanta, Ga.

553,557. Armature for Electric Machines. R. M. Gardner, Chicago, Ill.

553,572. Dental Light and Heater. F. H. Stafford, Chicago, Ill.

553,605. Composite Telegraphic and Telephonic Transmission. E. E. Backus, New York, N. Y.

553,632. Automatic Coal - Recording System for Railways. F. A. Walters, Denver, Colo.

553,633. Antiseptic Diaphragm for Telephones. E. Weschcke, San Francisco, Cal.

553,635. Underground Trolley System. N. H. Anspach, Chicago, Ill.

553,637. Electric Arc Lamp. E. J. Bagnall and G. Arnold, Cleveland, O.

553,673. Incandescent Lamp. H. Green, Hartford, Conn.

553,675. Electromagnet. C. D. Haskins, Brooklyn, N. Y.

553,697. Electric Arc Lamp. H. O. Swoboda, New York, and E. Lavens, Brooklyn, N. Y.

553,719. Electric Battery. J. W. T. Olan, New York, N. Y.

553,730. Electric Switch. J. C. Fagan, Watertown, N. Y.

553,732. Electrolytic Bath and Appliance. J. H. George, New York, N. Y.

553,736. Electric Railway System. J. E. Page, Chewacla, Ala.

553,799. Electric Railway. M. L. Wood, U. S. Navy.

553,819. Control System for Electric Motors. G. Sautter, Paris, and J. M. L. Slavatier and C. E. de Lagabbe, La Seyne, France.

Electric Vehicle Section

ELECTRIC TRUCKS AND THE CENTRAL STATION.

By J. A. McMeel.

That the electric commercial vehicle has won a permanent place as a trucking medium in the cities is now established beyond all question of doubt. The showing, in the nature of sales, made by all of the leading electric truck manufacturers during the year just closed seems to be the strongest kind of indication that the electric commercial machine is here to stay and is not merely on its way. Since the inception of the truck manufacturing industry a great deal of progress has been made, but never in its history has the increase in business been of such volume and at no time has the future looked so promising.

When it is said that the electric machine is here to stay it is not merely the opinion of a person whose enthusiasm over the situation has blinded him so that he is unable to see conditions as they really exist. In order to note the development which has been made in the past 12 months it is unnecessary to look further than one's own city, providing he is a resident of one of those cities in which the central station has taken a hand in shaping the future of the electric truck. However, whether one is or is not a resident of one of those cities, if he is in search of proof that the electric has established itself on a firm foundation it can be found in any of the large eastern cities. New York city, for instance, furnishes the best example of how rapidly the electric truck has come to the fore and the fact that machines of this type are being used extensively in that city is ample indication that it has been perfected to such an extent that it is entirely fit for commercial trucking.

The fact that New York City, Chicago, Boston and a good many other cities are using this type of machine on a large scale leads to the conclusion that the progressive firms of this country are gradually working towards economy in transportation and the future of the electric; or, in other words, the place it shall take as a commercial trucking medium in our cities, depends, to a great extent, upon the support given it by the parties most interested in increasing its use. That the central station is, or should be interested, is apparent. At least some of the most enterprising central stations have grasped the opportunity for increasing their revenue and filling in the night valley, and after careful and close investigation of the situation have launched out on vigorous publicity campaigns which are destined to bring about a wider use of the trucks among the merchants in their respective cities.

New York, Chicago, Boston, Denver and about a dozen other cities furnish excellent examples of what may be accomplished in pushing commercial electrics by a publicity campaign which will break the way for the electric. That the efforts of providing the proper spirit is instilled into these companies have been crowned with a well deserved success is manifested when it is known how many commercial machines are now employed by the merchants in each place. Of course, the development in some cities has been greater than in others, but this is entirely due to local conditions and the relative size of each city. However, the pioneering which is now being done by these enterprising central stations will break the ice and make future selling comparatively easy. At any rate in the cities where the introducing is now being done it will be easier to accomplish results and get the benefit of the business at an early date, than in those where the central stations are letting slip an opportunity that is most promising at the present time.

Statistics reveal the fact that there are close to 2,000 machines in the service of the merchants of New York City. One manufacturer, the General Vehicle Company, has sold trucks to New York merchants which if piled one on top of another would form a column 9,000 feet high or be just twelve times as tall as the Woolworth Building. Eighteen firms in that city employ a total of 1,099 electrics, an average of 61.1 cars each. Of these companies the Ward-Corby Company has 215 electrics, the American Express Company 104, the New York Transportation Company 125 and the New York Edison Company 107 trucks. Most of the brewers have electric equipment, and some of them have complete electric delivery systems. One of these brewers is making an annual saving of $800 with each truck employed, and another is saving $80,000 annually by the use of 58 commercial trucks of the electric type.

Then take Chicago. At the present time there are close to 500 machines in the service of Chicago business houses, and the number is being increased nearly every month. Recently one man in Chicago sold electric trucks to the value of $981,000 in a single month. The central station there has been quick to see the advantage of having the vehicle load, and it is conducting an extensive publicity campaign to encourage the use of the vehicles. To show that it has absolute faith in the ability of this type of machine it is using 69 electrics itself. Boston, too, is another city in which great strides have been made. Nearly 250 trucks have been installed there in a little less than two years, and a campaign is now being conducted to greatly strengthen that number. Then there is Denver with 60 electric trucks taking nourishment from the central-station lines, and the campaigning there has only commenced.

In view of the progress which is being made by these enterprising central stations it would seem that any company which has not taken the pains to look into the situation is overlooking a big bet, and in time to come the proposition of introducing electric machines into their localities will be a rather tough one. There is no question but what the electric will make progress whether the central station helps along with the good work or not, but it is certain that its progress will be accelerated if the combined efforts of the central station and the manufacturer are put behind a movement to give the trucks greater publicity.

The manufacturer is for co-operation. Most of them, if not all of them, are willing and glad to lend a helping hand to further the cause and the central stations may avail themselves of material which proves beyond question that the electric is economical, reliable and powerful. There is a wealth of this material at the disposal of any one who desires it, at least that has been the experience of the Denver company, which has called upon the manufacturers on a number of occasions for interesting reading matter and pictures for publication in its magazine—"The Electric Vehicle."

Persons most familiar with the electric vehicle situation come forward with the information that the reason the electric trucks has not made a more decided progress is due to the fact that the average business man is familiar with but one kind of automobile. That

it is not the electric can be readily understood when it is considered that the number of automobiles of other kinds of power in the service of the business men of this country far outnumber the electric pleasure cars in use. Naturally, when these men consider buying trucks they think of only one type of motor, and for that reason the electric loses a chance of a hearing. This is a state of affairs which must be changed, and the only way that it can be done is to provide more publicity for the electric.

In this respect the Electric Vehicle Association of America is doing a great work in its publicity campaign in the leading magazines, but it is absolutely necessary for the central station, which understands conditions in its own town, to take a hand in the affair, before a big demand for this type of truck can be developed.

Authorities say that there are nearly 55,000 motor trucks of all kinds in the service of the business establishments of this country. Of this number less than 10 per cent, or 6,000, are electrics. What is the reason for this? It has been persistently announced that electrics can economically handle 80 per cent of the trucking in our cities, but from the foregoing figures it is certain that they are not doing nearly that amount. There must be something retarding the adoption of electric truck service. It is not because the machines are not fit, so therefore it must be because of the disinterestedness of those who should be vitally interested.

Indication of the progress which has been made during 1912 is found in the production figures of the manufacturers. The General Vehicle Company, which claims the distinction of selling fleets and which has supplied 103 central stations with machines, did a thriving business last year. Although this company has been manufacturing trucks for the last 11 years, the output of its factory for 1912 represented 22.7 per cent of its entire production to date. These figures surely indicate what has been done, and give some idea of the business that is still waiting to be secured. A peculiar thing about the 1912 growth is that it has been in spots, that is, the demand for trucks has kept within the regular channels, although Cincinnati, Richmond, Va.; Baltimore, San Francisco, and several other cities have broken into the order column during the last 12 months.

The Baker Electric Vehicle Company has had its truck department established two years. The increase in business last year over 1911 was 280 per cent. Fully 70 per cent of this business was in the nature of repeat orders, which indicates that the firms which have tried electrics always come back for more. The sale of pleasure vehicles was 25 per cent greater than ever before.

The American Express Company, which has close to 300 electric trucks in operation in the various cities in which it has branch offices, was among the largest purchasers from the Baker company. A single order from this concern called for the delivery of 232 trucks.

All of the other well-known vehicle manufacturers have had big increases this year and every one is looking forward to 1913 being the most prosperous year in their history. It is the claim of one of the largest cities in this country that there is $200,000,000 worth of electric truck business yet to be obtained, and it is predicted that some $10,000,000 worth of trucks will be placed in service in 1913. How much of this is coming your way?

The National Automobile Show at Chicago.

The National Association of Automobile Manufacturers, Incorporated, will hold its annual automobile show in Chicago from February 1 to February 15. The exhibit of the passenger vehicle section will be held from February 1 to February 8, and the exhibit of the commercial vehicle section will be held from February 10 to February 15. The exposition will be held in three buildings—the Coliseum, the First Regiment Armory and the Wilson Building, all connected.

This will be the thirteenth show in which the entire industry embracing gasoline, steam and electric vehicles and accessories of every description, have participated under the same management. The gross amount of space occupied the first week of the show will approximate 147,000 square feet, and the second week 135,615 square feet. There will be 102 passenger car exhibits and 76 commercial car exhibits at the Chicago show. These figures were respectively 88 and 65 at the recent New York automobile show. There will be 564 accessory exhibits.

The lowest priced car exhibited at the show will be valued at $395, and the highest priced car $7,000. The principal changes to be seen this year will include self-starting systems, electric lighting, increased proportion of six-cylinder gasoline cars, the introduction of wire wheels, increased number of left-hand control, and longer stroke motors in the gasoline vehicle section. The more recent types of electric vehicles with low slung bodies and seating arrangements so that all the occupants face in the direction of driving, will be shown.

1913 Models in Electric Passenger Vehicles and Commercial Trucks.

Among the many beautiful and practical models designed for 1913, the Rauch & Lang electrics maintain their reputation for undisputed excellence. The Rauch & Lang Carriage Company has been making vehicles for a discriminating trade for the past 50 years, and in each vehicle period has gained a special recognition for the production of the highest type of period equipment.

On the following pages may be seen illustrations of the roadster model R, the club roadster model C-R, the demi-brougham model D-B, the brougham model B, the brougham model X-T, and the town car model T-C.

One of the most appreciated features of the Rauch & Lang car is the body with its attending luxury and comfort. The interior is fitted with big, deep cushions making for easy riding, and the workmanship and material are not only of great strength and durability, but carefully selected for their beauty and popularity.

The Broc Electric Vehicle Company emphasizes especially the room and comfort which its models afford the occupants of its carriages, and it is undoubtedly a fact that the graceful interior and the additional luxury of special appointments will prove to be a great factor in convincing central-station men that cars of this type will appeal to a large number of buyers. The accompanying illustrations give a good idea of the handsome interior of several of the Broc Electric Vehicle Company's equipments.

The Anderson Electric Car Company has developed a very handsome line of 1913 models. Several of these are shown in the accompanying illustrations. This company features particularly the model 42 clear-vision brougham. The primary feature is its method of seating all passengers facing in the direction of travel instead of carrying some of them in a backward position as has heretofore been the practice. The problem was not so much to design a car which would provide this feature as to do it without unnecessarily enlarging the car as a type and making it unwieldy in handling. This vehicle accommodates four or five passengers with ease. The two front seats are of the individual type, the one on the left being for driving purposes, the one on the right being the folding type which can, of course, be kept out of the way when not in use. The position of the driver's seat is such as to not make the person driving in any way conspicuous even when occupying the vehicle alone. The satisfactory working out of this feature has been largely responsible for the popularity of this car, and the company states that its faith in its ability to suit the majority of demands is justified by the heavy sales of this vehicle all

G. V. ELECTRICS
AT THE CHICAGO SHOW

YOU will find the G. V. Exhibit in the Armory this year, in 1200 square feet of space. Look for the following vehicles:

2000 lb. panel wagon—Schulze Baking Co.
2000 lb. Industrial Truck
2 ton truck—Heileman Brewing Co. (bottle type)
3½-ton truck—H. J. Heinz Co.
5-ton truck—Fort Wayne Lamp Works

There is always something interesting at the G. V. Exhibits, so don't fail to look it up when in Chicago.

Catalogue 85 on request.

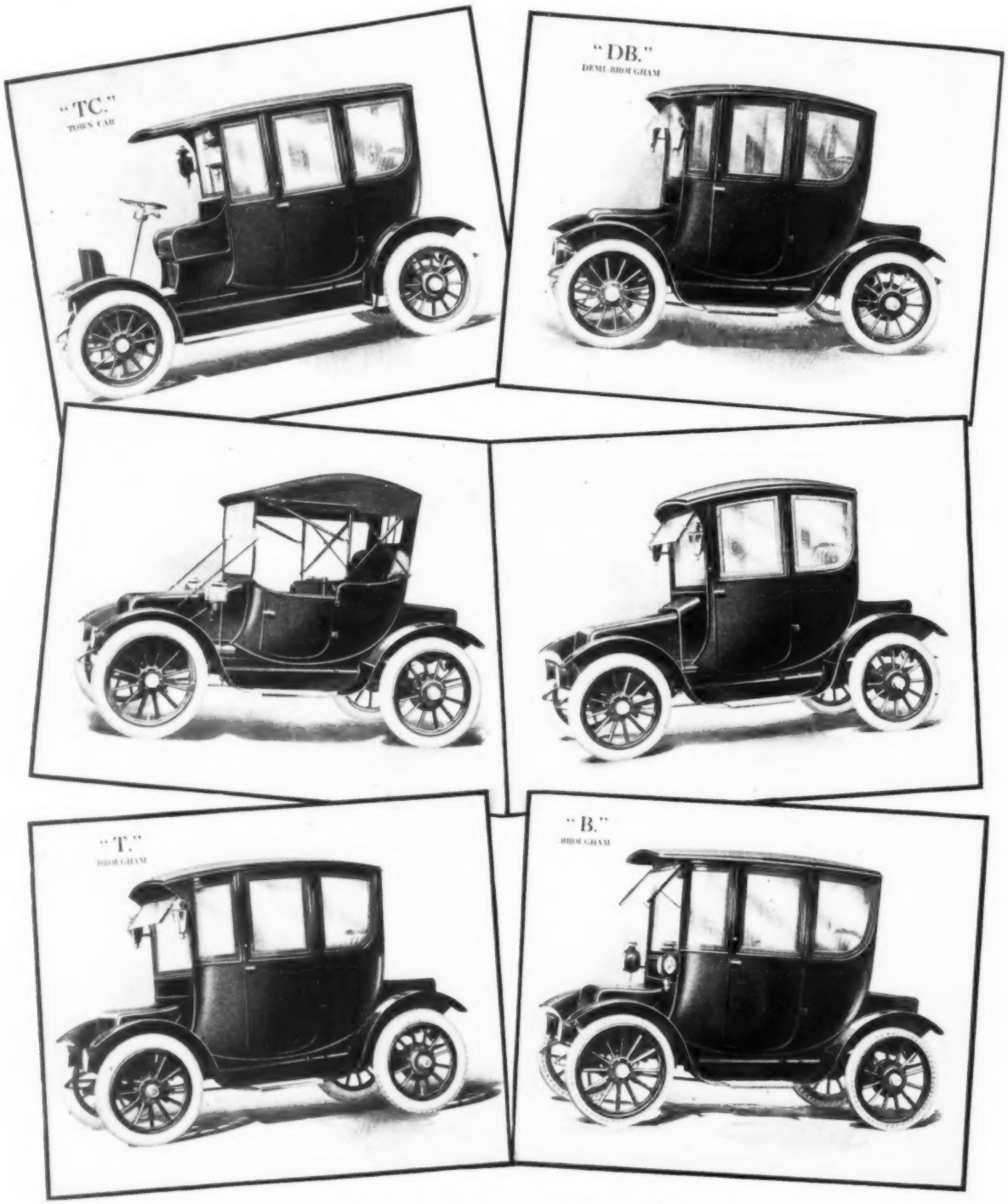
The General Vehicle Company, Inc.

Principal Office and Factory
Long Island City, New York

New York Chicago Boston Philadelphia St. Louis

over the country. Another feature of the Detroit electric is making the rear quarter windows of glass instead of wood as heretofore. These glass windows very materially facilitate driving the car and allowing the occupants to see on all sides and at the rear with the least possible difficulty.

Woods electrics, made by the Woods Motor Vehicle Company, are made in six models for the new season. The new Woods models are a distinct departure from what has become accepted as Woods' design. The body lines particularly have been refined. There is less stiffness, with more of a tendency to redundancy and grace in contour. The bodies are much lower to the ground than last year's models, although this feature has not been overdone. The lowering of the car is accomplished by a drop chassis frame and is sufficient to bring the step just right for easy entrance from either curb or the roadway. The company is featuring an open victoria seating four passengers, and a two-passenger roadster which follows similar lines of the gasoline cars, particularly in the construction of the forward hood. Other popular models are the vis-a-vis type



Rauch & Lang Electrics—Models for 1913.

Central Stations Commercial Electric Vehicles and The 4 "Exide" Batteries

"Exide", "Thin-Exide", "Hycap-Exide", "Ironclad-Exide"

These three are closely allied—in fact they are inseparable—the interests of one are the interests of all.

Central Stations *know* that one of their best and biggest opportunities for increasing business is through the charging of commercial electric vehicle batteries.

Electric trucks and delivery wagons are big consumers of current and battery charging offers the ideal off-peak load.

Central stations should therefore make every effort to increase the use of electric vehicles, *and see that users get good service.*

Service is largely a matter of *battery reliability.* When it comes to the question of batteries, *the interests of Central Stations will be best promoted* by endorsing the four "Exide" Batteries.

The manufacturers of electric cars have made a *thorough* study of vehicle batteries. This has resulted in twenty-four of the prominent makers using and endorsing the "Exide", "Hycap-Exide", "Thin-Exide" and "Ironclad-Exide" Batteries.

One of these four vehicle batteries—each having its own special features—will exactly meet the requirements of *any type* of electric commercial or pleasure car.

We want to help the Central Stations to develop this business in every way possible. We can be of assistance to you. Talk the matter over with our nearest Sales Office.

THE ELECTRIC STORAGE BATTERY CO.

MANUFACTURER OF

The "Chloride Accumulator", The "Tudor Accumulator"

The "Exide", "Hycap-Exide", "Thin-Exide" and "Ironclad-Exide" Batteries

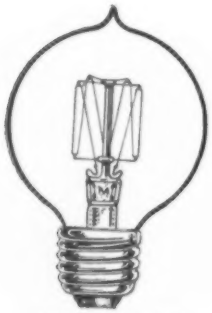
New York Boston Chicago St. Louis Cleveland Atlanta Detroit

PHILADELPHIA, PA.

1888-1913

Denver San Francisco Seattle Los Angeles Portland, Ore. Toronto

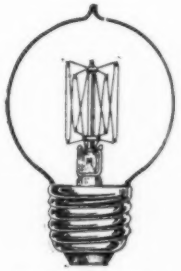
Electric Vehicle Equipment



(½ Size) 15 and 25 watts, 21-90 volts

Three-gang Push Button Switch

Commercial vehicle charging receptacle and plug



(¼ Size) 15 and 25 watts, 21-65 volts

Edison Mazda Lamps, Commercial vehicle type, are of the same high efficiency as the well-known Edison Mazda Lamps used for all kinds of lighting the world over. These lamps have strong, sturdy filaments, made from drawn wire tungsten that will withstand the jarring and jolting of the roughest roads.

Flush Push Button Switches are our well-known standard push button switch in miniature. The switch is compact and takes up very little space. The buttons are metal and will not break off; the terminal plate at back is held by long screws which prevent loosening. Made in any combination of gangs.

Charging Plugs and Receptacles are substantial and strong; they withstand any reasonable amount of rough usage. The self-centering plug forms a rigid electrical connection between contacts; the generous areas assure transmission of charging current at the maximum of efficiency. Well insulated against accidental contact. Receptacle has a self-closing cover, protecting removable interior from moisture and dirt; interior walls enameled to prevent rust. Any of these devices may be obtained from local dealers or our nearest sales office.

List of Sales Offices on Second Page Before Editorial Section

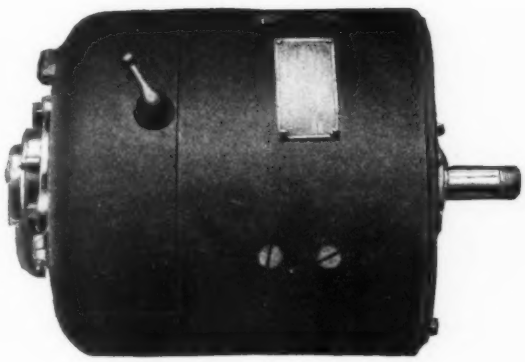
General Electric Company

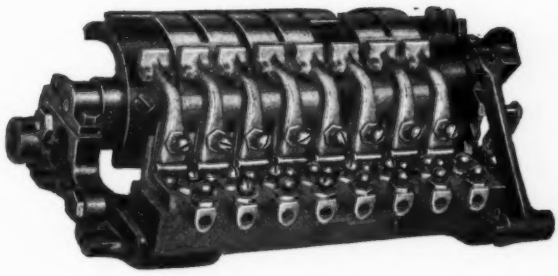
Largest Electrical Manufacturer in the World

3871

The Guarantee of Excellence — on Goods Electrical.

Electric Vehicle Equipment





Leading Makers of Electrics Use G-E Motors and Controllers

The best "argument by example" that General Electric Company's automobile motors and controllers hold an established reputation as the most reliable and efficient equipments made, is proven by the use of these outfits on SIXTY-FIVE PER CENT of Electric pleasure and commercial vehicles made by the leading manufacturers in this country.

The manufacturer who safeguards his reputation by adopting GENERAL ELECTRIC COMPANY'S motors and controllers as standard, is thus able to concentrate greater attention upon the comfort, convenience, finish and general detailed improvement of car body and chassis.

The electric vehicle equipped with G-E motors is doubly backed: first, by its maker, and second, by the reputation of the largest electrical manufacturer in the world.

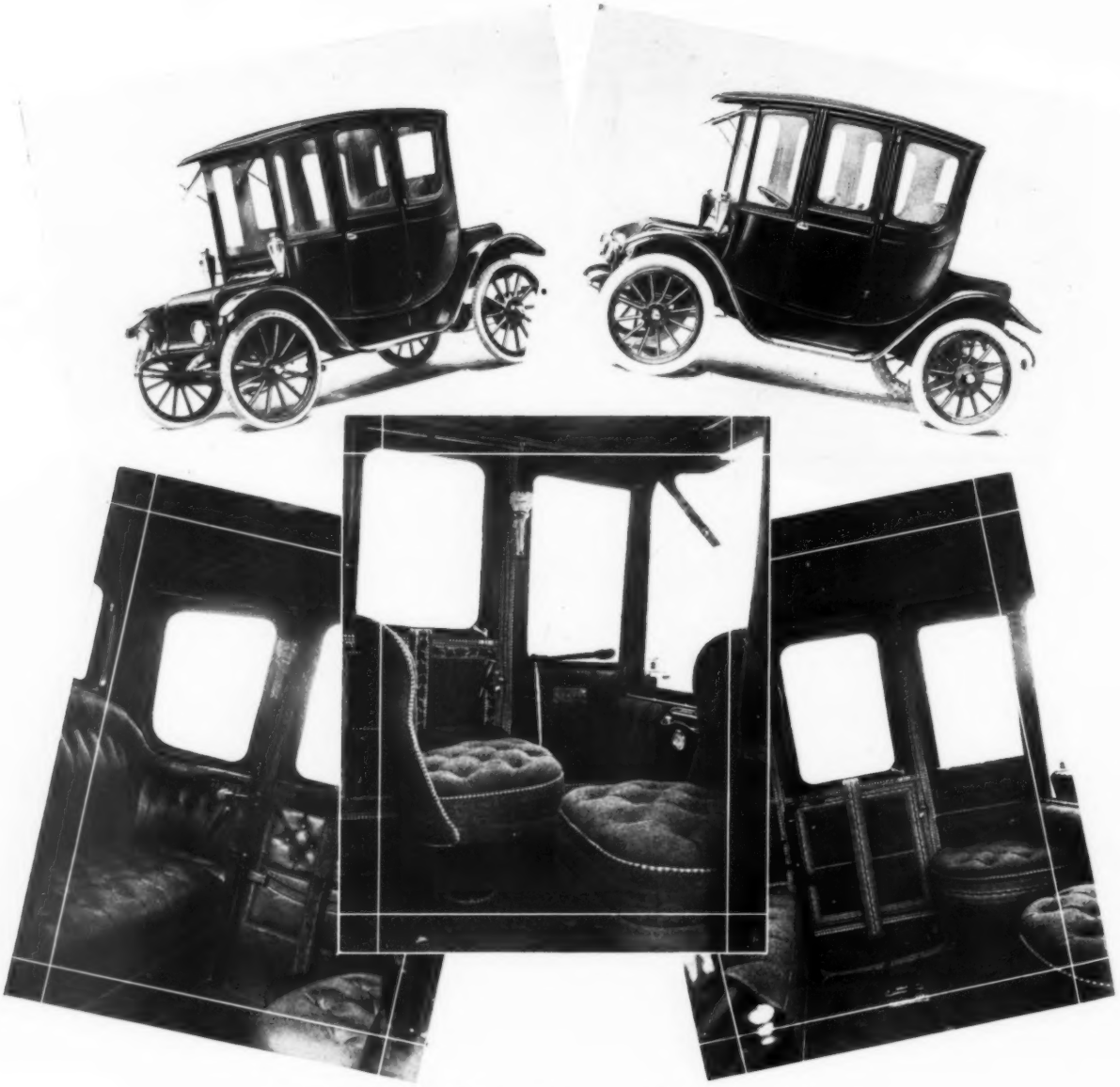
If you are a prospective purchaser of an electric vehicle, DEMAND General Electric Company's motors and controllers!

General Electric Company

Largest Electrical Manufacturer in the World

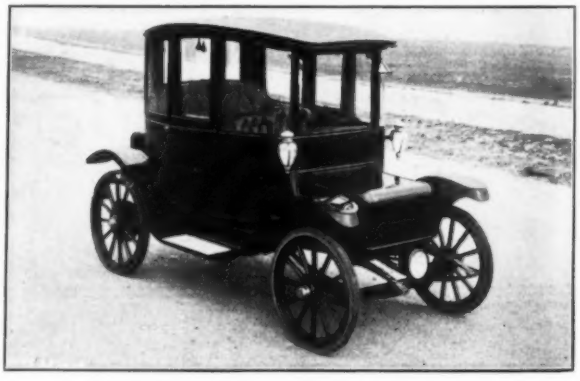
3406

The Guarantee of Excellence - on Goods Electrical.



The "Luxurious Broc"—Some Handsome Inside and Outside Views.

Woods Two-Passenger Roadster.

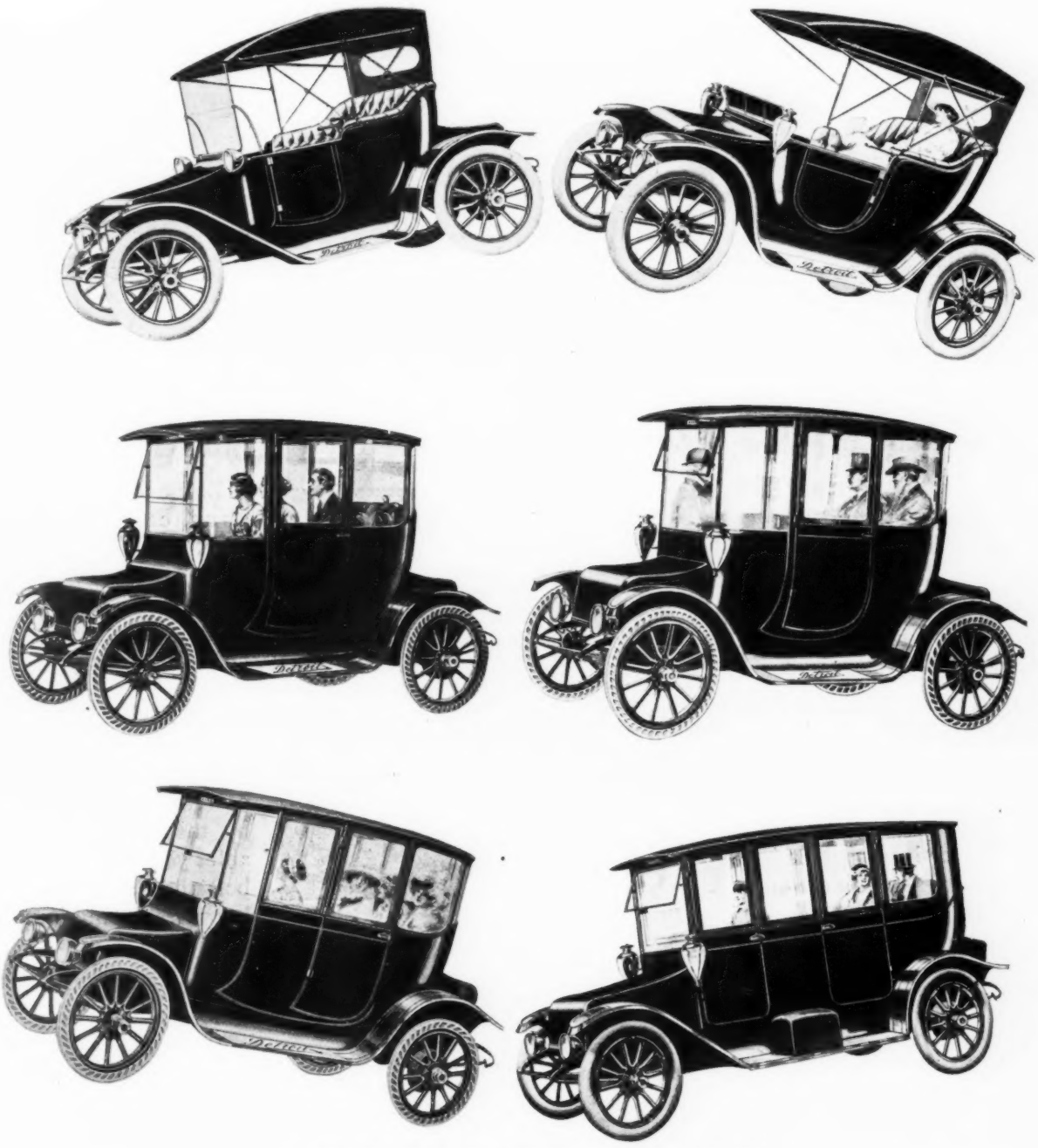


Woods Open Victoria.

and a pony limousine, the seating arrangements being such that all occupants of the car may face to the front.

The Waverley Company is presenting several handsome models in passenger vehicles, several of which are illustrated herewith, and is featuring to great advantage a strong line of electric trucks. The increase in the electric truck business all over the country has gone forward by leaps and bounds. Among the sales recently made by the Waverley Company are to the Adams Express Company, to the American Express Company, to the L. S. Ayres Department Store, to the Fleischmann Company, to Mandel Brothers Department Store, four light delivery wagons and six business roadsters to the Louisville Lighting Company, and many others for similar service. The Waverley Company is featuring a 1,000-pound delivery wagon of the shaft-driven type

The General Vehicle Company is maintaining its prestige for sales of electric trucks both single and in fleets. A number of interesting illustrations of General Vehicle trucks are shown herewith. One illustration shows the first electric brewery truck manufactured by the General Vehicle Company for the Central Brewing Company of New York. This truck has been in daily service for over 10 years. Another illustration shows a phase of horseless transportation which the General Vehicle Company has conquered successfully. This truck is in the service of the San Francisco Gas & Electric Company at San Francisco, Cal., and shows that either up hill or on level

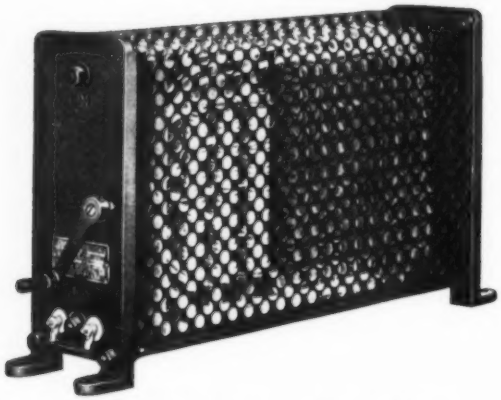


The 1913 "Detroit" Electrics, Anderson Electric Car Company.

Battery Charging Equipment

Perfection in Every Detail

The Improved CR-211 Rheostat



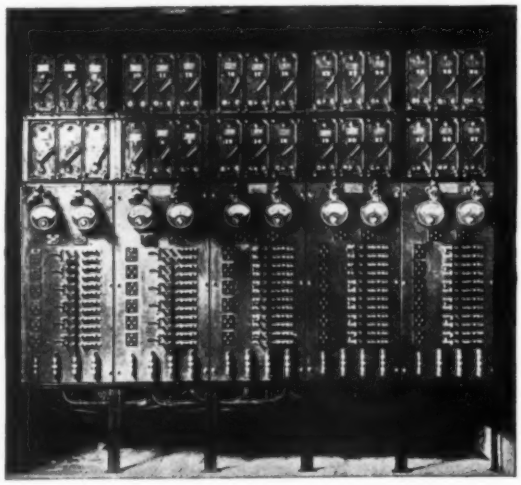
For Vehicle Battery Charging

Here Are the Features Which Combine Convenience with Safety and Allow Maximum Returns from Your Equipment

The perforated metal cover protects the parts from injury, eliminates the possibility of accidental contact and yet provides ample ventilation.

This cover is easily removed, allowing complete inspection and access to all parts.

Connections to terminals may be made on the inside or outside of the case as desired.



Switchboard of Public Garage Equipped with CR-211 Rheostat

Large numbers of contact insures maximum regulation of current.

Can be placed on the floor, wall or switchboard of the garage.

The large number of sizes standarized by this company enables you to select the best rheostat for your batteries at minimum cost.

Standard Lines for Both Lead and Edison Type Cells

in all capacities, from the smallest ignition cells to the largest vehicle batteries. Explained and illustrated in the New Bulletin No. 4934. Furnished on request.

Ask about the new CR-211 Rheostat for charging Edison cells at normal or double normal rate.

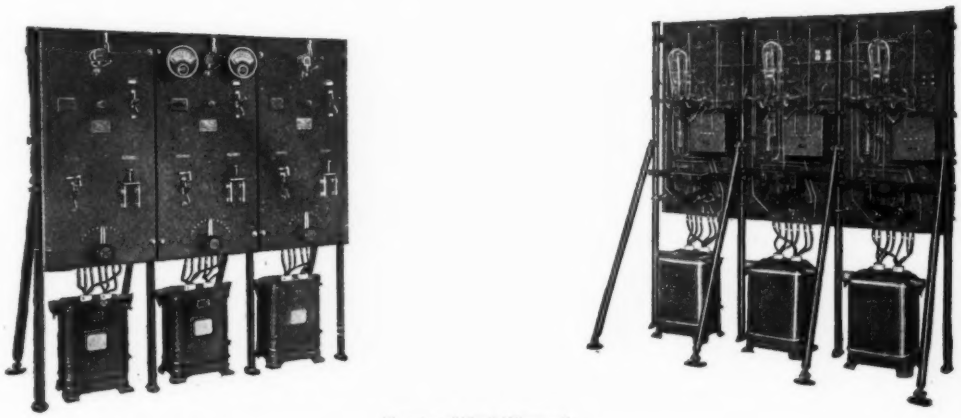
General Electric Company

Largest Electrical Manufacturer in the World

3472

The Guarantee of Excellence — GE — on Goods Electrical

Battery Charging Equipment



Front and Back Views of
Three Panel Commercial Vehicle Type Rectifier. This set will charge three vehicles at once.

Convenience in Battery Charging With Mercury Arc Rectifiers

The idea that charging storage batteries is a mysterious and difficult operation has been handed down from the days of the earliest electrics when charging stations were few and far between and the charging outfit for the private garage was unknown.

These conditions have been changed by the invention of the rectifier, which rectifies or changes the alternating current furnished by most lighting and power companies, to direct current suitable for charging storage batteries.

With one of these rectifiers in the garage, all that is necessary to charge the battery is to insert a plug in a receptacle on the vehicle and start the rectifier.

The rectifier takes up very little space in the garage and can be installed anywhere there are electric light wires.

In nearly every case the electric power company will make very low rates for energy for battery charging.

Write our nearest office for further information and prices.

See list of offices on second page before editorial section

General Electric Company

Largest Electrical Manufacturer in the World

3390

The Guarantee of Excellence--

on Goods Electrical.

streets the adaptability of the electric truck to all conditions is one of the many reasons for its wide and growing popularity. The Parkhill Fabrics Company of Fitchburg, Mass., is enthusiastic over the splendid showing made by its G. V. electric truck. This truck has to withstand very severe service because of the steep grades around that section of New England. Another illustration shows one of the fleet of G. V. electrics in the service of Arnold, Constable & Company of New York City. The fact that this company has sent in many repeat orders speaks well for its belief in the electric truck and the G. V. product. Illustrations similar to these might be multiplied indefinitely, and in later issues the equipment of other leading manufacturers will be adequately illustrated.

RELATIVE IMPORTANCE OF THE ELECTRIC TRUCK AS COMPARED WITH OTHER CLASSES OF CENTRAL STATION BUSINESS.[1]

By H. W. Hillman.[2]

In the early 80's it was quite out of the question to even consider a subject of this kind. Certainly it was too early to think of a street railway load. It was a period long before miscellaneous heating devices and household utensils had been developed, and the splendid, ever increasing industrial motor business was unknown to the central-station manager.

To-day, however, there is such a variety of electric devices and so many branches of business that need attention, that it surely becomes interesting to analyze the relative importance of the more prominent classes, and to show why one class differs from another class in character and in importance.

What is it that makes one class of business more important than another class to the central station?

It is difficult to remember a time when central stations did not pursue the familiar policy of favoring long-hour business. No one would think of questioning the policy, and so we are led to emphasize that electric trucks

Waverly Electrics—Models for 1913.

1 A paper read before the Electrical Vehicle Association of America, New York, January 21.

2 General Vehicle Company, Long Island City, N. Y.

Books on Electric Vehicles

The Automobile Hand-Book

By L. ELLIOTT BROOKES, Assisted by Other Well-Known Experts

Revised and Enlarged 1911 Edition. 16mo, over 650 Pages and over 320 Illustrations. Full Leather Limp, Round Corners, Red Edges. Price $2.00.

The automobile hand book is a work of practical information for the use of owners, operators and automobile mechanics, giving full and concise information on all questions relating to the construction, care and operation of gasoline and electric automobiles, including road troubles, motor troubles, carbureter troubles, ignition troubles, battery troubles, clutch troubles, starting troubles. With numerous tables, useful rules and formulas, wiring diagrams and over 320 illustrations.

Power transmission is thoroughly discussed, and the various systems of transmitting the power from the motor to the driving axle are analyzed and compared.

The perusal of this work for a few minutes when troubles occur, will often not only save time, money, and worry, but give greater confidence in the car, with regard to its going qualities on the road, when properly and intelligently cared for.

This is a brand new book from cover to cover—1911 Edition—and must not be confounded with any former editions of this popular work.

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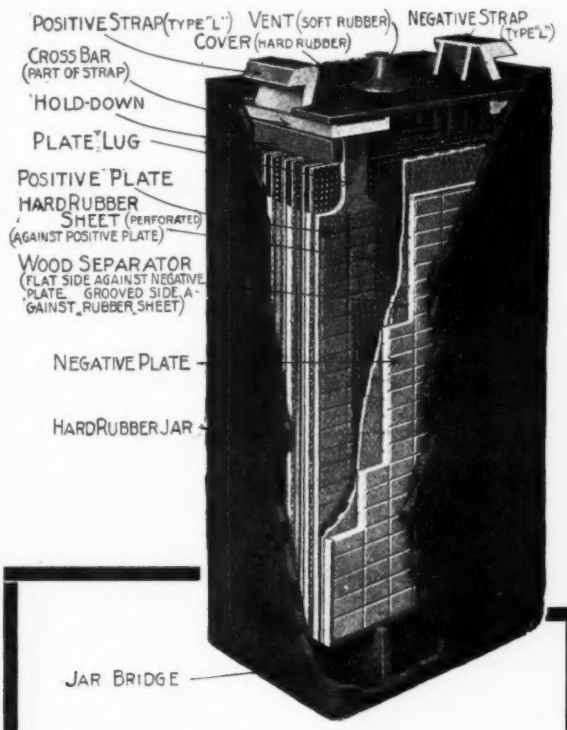
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PLATE LUG
POSITIVE PLATE
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offer the desirable long-hour business.

As we advance with our argument, it will be found that this long-hour feature stamps the electric truck branch as of far greater importance than many central stations have begun to realize.

It was the long-hour business which first attracted central stations to the industrial motor load. It was long-hour business which led to such effective organization among the central stations in connection with power bureaus and industrial motor salesmen.

Now it is a rare occurrence to visit a light and power company that has not vigorously promoted the motor business.

The National Electric Light Association has recently sent out some very interesting data relating to 114 motor installations. It was issued in book form by the commercial section and reflects great credit upon the work and activity of that body. Among the motor departments of all the central stations, it will be found of daily value.

It is interesting while perusing this compilation carefully to note that 29 installations out of 44, which show load-factor indicate that it is not over 10 per cent. Thus we see that it is not over three hours per day that the 29 installations are in service.

It is common knowledge that electric trucks are on charge six to eight hours each and every night, and surely we are warranted in claiming a marked advantage for the electric truck on account of such long-hour business.

This load factor of 30 to 35 per cent is uniform. It does not vary with the size of the truck nor with the number of batteries on charge; except as has been forcibly brought out, that in a large size garage one-half of the installation can be charged the fore part of the night and the balance the latter part. By this practice the central station secures a 12 to 16-hour load of uniform and highly desirable character.

Next your attention is drawn to the low demand of electric truck.

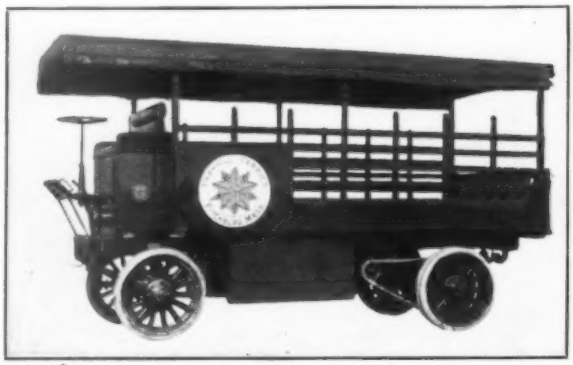
For the same amount of plant equipment necessary to operate, the electric truck has eight and one-half times the earning capacity of the electric flat-iron.

While it takes 86 irons to equal the annual income from one two-ton truck the irons demand 51.6 kilowatts to operate, against six kilowatts for the truck.

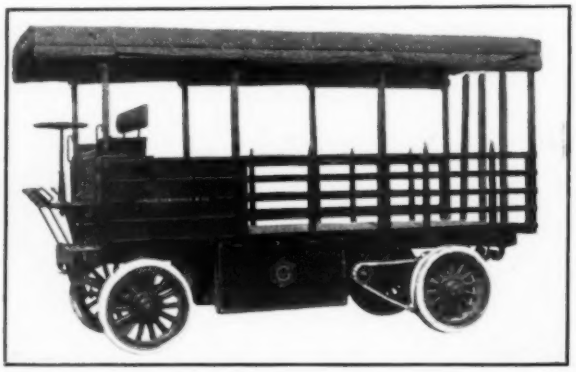
For fear that some sales manager may question my comparison of the small electric iron with the large important truck, I have made comparisons with 12 classes of central-station business other than the irons; that is, I have marched boldly into his camp with practically every branch of business associated with the electrical industry.

G. V. Brewery Truck—Over 10 Years in Service.

A Hill-Climbing G. V. Truck in Service at San Francisco.



Parkhill Fabrics Use the G. V. Electric.



One of a Fleet of G. V. Electrics in New York City.

Annual Income per Kilowatt of Plant Equipment Necessary to Operate 12 Different Classes of Installations.

Installations.	Annual Income per K. W.
1. One two-ton truck	$ 86.00
2. Residence, small	15.22
3. Retail store, small	31.75
4. Church	32.57
5. Industrial, 1 motor	43.16
6. Industrial, 2 motors	41.18
7. Industrial, 3 motors	19.61
8. Industrial, 8 motors	50.96
9. Industrial, 20 motors	35.11
10. Residence, large	63.04
11. Drug store	118.40
12. Saloon	191.51

ELECTRIC TRUCKS and WAGONS

SHOULD BE THE

Most Profitable Single Source of Revenue for Central Stations

Intelligent progress in securing this kind of business can be made only by keeping correctly informed on all phases of motor road transport. The **Best Way** to do this is to read

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Above comparison is made from data recently secured from 30 central stations, showing average rate per kilowatt-hour, monthly consumption in kilowatt-hours, maximum demand per kilowatt and connected load.

Size of cities as follows:

1 in excess of 1,000,000 population.
4 between 200,000 and 500,000 pop.
7 between 100,000 and 200,000 pop.
8 between 50,000 and 100,000 pop.
9 between 25,000 and 50,000 pop.
1 less than 25,000 population.

The above table of comparison brings out clearly that the electric truck business stands at the head of the list as an income getter. It stands at the head of the list in respect to the small demand upon the plant equipment, and again it stands at the head of the list for long-hour business.

Glance for a moment at the five motor installations in the table.

Who would have thought that electric trucks would make such an excellent showing when compared with the prize branch of the central-station business; that branch, the rapid and extensive development of which has astonished the entire industrial world; a business now rich with power bureaus, power engineers, power solicitors and power accomplishments second to none in connection with the history of the electrical industry.

In a western city some 1,350 houses were wired during a period of 18 months. Only 67 extensions had to be made "off the lines," and only six solicitors were employed to promote this business.

Many a central station has conducted a similar campaign, and has thus not only prepared the way for a large residence lighting business but likewise arranged so as to easily promote business later, covering miscellaneous heating devices and household utensils.

Like the motor business all of this work is admirable. But if the central-station sales manager realized that only 50 electric trucks would produce the same annual income which is derived from 1,350 houses, would he start out boldly with six solicitors? Would he adopt an aggressive policy if some one should remind him that all the truck business could be taken on without the purchase of any additional plant equipment? Would he put on twice six solicitors if he actually realized the value of long-hour business and the enormous field which is loudly calling for promotion and development? Will it encourage the central-station sales manager to employ truck salesmen when he realizes that in the Newark territory 181 electric trucks have been placed in operation with the excellent result that the automobile department showed a profit even during the year 1912?

Returning again to the point of low demand.

This is a feature of vast importance and perhaps can be emphasized most forcibly at this time by reminding you of the high demand of certain other classes of business and the effect upon the development and growth of such business.

Let us consider the situation regarding an electric cooking baking outfit for the residence kitchen.

It advanced from the laboratory into the engineering department; from there into production and was commercialized to a limited extent. But electric cooking and baking by electricity is not being extensively exploited. The demand is too high for the income possible.

The oven alone had a demand of 2.2 kilowatts. With the addition of the meat broiler, the cereal cooker and the variety of necessary cooking appliances the demand would run as high as five kilowatts; to be conservative let us say four kilowatts. This is two-thirds of the demand required for a two-ton truck which has an annual earning capacity of $516. But the cooking and baking outfit has to compete with coal at $7 per ton, and at a special rate of five cents per kilowatt hour my bills for five consecutive years averaged $5.66 per month in a family of five with one servant. In other words with two-thirds the demand the annual income would be about $68 against $516 for the truck.

Most energetic efforts have been made to lower this demand by utilizing the principle of the fireless cooker for conserving heat, but until this is effectually accomplished electric cooking among residences will not be extensively exploited because of high demand; because it does not possess the advantageous feature of low demand which the electric truck enjoys.

I want to emphasize this point of low demand still further by referring to another branch of business in connection with which high demand has held back development and commercial exploitation by the central station.

In building my house at Schenectady I wired completely with heavy feeders for a thorough test of electric house-heating.

For months my furnace was not operated at all and entire dependance was placed upon the electric heating system. In six rooms upstairs one kilowatt each was required. In the large living room down stairs three one-kilowatt heaters were installed. The complete installation required 12 kilowatts or twice the demand of a two-ton truck.

To compete with coal the annual income should not be more than $125 to $150 for heating that size of residence. Thus we see that with only one-fourth the income of the electric truck the demand would be approximately double. It would be a great burden on the central stations to exploit electric house-heating at the present time for the reason of high demand. Such a class of business requires that the current be distributed into out-lying territory. Even if generator capacity could be easily secured or if it were at present available, extensions would be required all along the line.

But this is not true regarding the electric truck business. It not only possesses the advantage of low demand but the current does not have to be distributed into the out-lying territories. Without change of any of the system the business can be exploited. Neither a change in the distributing system nor a change in the station proper; not even increased generator capacity, because the batteries are charged at night.

Was there ever a branch of business possessing such splendid advantage! Is it any wonder that sales managers are beginning to organize to handle electric truck business aggressively?

I have shown that the current is abundantly available. We all know that electric trucks are thoroughly developed and successful as a commercial product. What the business needs is the benefit of the sales manager's experience, his judgment, his approval, his influence with the public, his influence with his own organization. Wherever this policy prevails there we may look for progress.

Baltimore, for example, adopted this policy, and better yet has organized to push the sale of electric trucks.

Besides the great advantage gained from the hearty support of the sales manager there is an automobile department and its manager. He has a truck salesman, giving undivided attention to the subject.

On a recent important deal five truck men were available, impressing the customer with the idea that the Baltimore Company is intensifying the truck business.

This is one of the reasons why upwards of 75 trucks have been placed by that company in a comparatively short time.

We appeal for the same intensity and activity which the sales manager puts into the subject of isolated plants.

We appeal for the same character of literature which is found in the power bureau, which is distributed to customers and which reads something like this:

"We will gladly send a motor engineer to your factory; we will make a test of your steam plant; we will submit to you a proposition showing the economy by the use of our motor service." That will imply that truck salesmen are available to send out; that they are posted to meet the arguments of competitors; and that they are educated regarding all kinds of batteries.